

To: Deltoral, Miguel[deltoral.miguel@epa.gov]; Schock, Michael[Schock.Michael@epa.gov]
Cc: Bosscher, Valerie[bosscher.valerie@epa.gov]; Lytle, Darren[Lytle.Darren@epa.gov]; Poy, Thomas[poy.thomas@epa.gov]
From: Porter, Andrea
Sent: Mon 11/30/2015 1:58:39 PM
Subject: flint, link to story --> "Engineer gets \$907,000 contract add-on to prepare Flint for KWA water"

Hi All,

Did everybody already know about this?

Source:

http://www.mlive.com/news/flint/index.ssf/2015/11/engineer_gets_907000_contract.html#incart_story_package

“Engineer gets \$907,000 contract add-on to prepare Flint for KWA water

Ron Fonger | rfonger1@mlive.com By Ron Fonger | rfonger1@mlive.com

on November 23, 2015 at 7:06 PM

FLINT, MI -- The engineering company that's been working with the city at its water plant will continue to as Flint prepares to treat raw water from a new Karegnondi Water Authority pipeline.

The City Council approved a change in the contract with Lockwood, Andrews & Newnam that will pay the company \$907,650 to continue its work.

The change in the 2013 contract means the company will collect a total of up to \$3.8 million for its work on Flint water issues, an arrangement that started when the city agreed to pay LAN \$1.3 million to study the feasibility and develop cost estimates for using its water plant as a primary

water source.

The work proposed in the change order covers specific items including jar testing of the new Lake Huron water source and managing construction activities at the plant in advance of connection to connecting to the KWA line that's currently under construction.

Some council members questioned City Administrator Natasha Henderson about the change order last week, but Henderson said the contract change was necessary to keep the KWA pipeline project moving forward.

"We have a nine-month contract (to purchase water from the Detroit water system)," Henderson told council members last week. "Whatever I can do to get the city to KWA," I'm doing, she said.

Council member Scott Kincaid said last week that he wasn't happy with the engineering company, "but I haven more concerns with" a possible delay in connection to the pipeline.

Councilman Eric Mays also said he was unhappy with LAN for remaining "too silent" while the city had difficulty producing water that did not violate the Safe Drinking Water Act and the Lead and Copper Rule.

Flint had purchased treated Lake Huron water from the Detroit water system for decades until April 2014 when the city began to use Flint River water until completion of the KWA pipeline.

After the discovery of elevated lead levels since that water source switch, the city returned to buying water from Detroit last month.

Council approved the change order in the LAN contract by a vote of 6-2.

Council members Eric Mays and Monica Galloway voted against the change order.

Council members Jacqueline Poplar, Kerry Nelson, Josh Freeman, Wantwaz Davis, Vicki VanBuren, and Scott Kincaid voted for it.

Councilman Herbert Winfrey was absent from the meeting.”

Thanks,

Andrea Porter

Environmental Engineer

Ground Water & Drinking Water Branch

U.S. EPA, Region 5 (WG-15J)

77 W. Jackson Blvd.

Chicago, IL 60604

Phone: 312-886-4427

Fax: 312-697-2656

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From: Schock, Michael
Sent: Mon 11/30/2015 2:23:01 PM
Subject: RE: flint, link to story --> "Engineer gets \$907,000 contract add-on to prepare Flint for KWA water"

We did know they were getting extra money, and we did get queries about what kind of benchtop study could they do to allow the plant to turn on and immediately send the startup water out into the distribution system, fully-treated.

Personally, I'm disturbed by the timeframe for the water change and lack of exploration of options for allowing sufficient time to the proper kinds of studies and plant testing to be done before switching over to the new supply.

From: Porter, Andrea
Sent: Monday, November 30, 2015 8:59 AM
To: Deltoral, Miguel <deltoral.miguel@epa.gov>; Schock, Michael <Schock.Michael@epa.gov>
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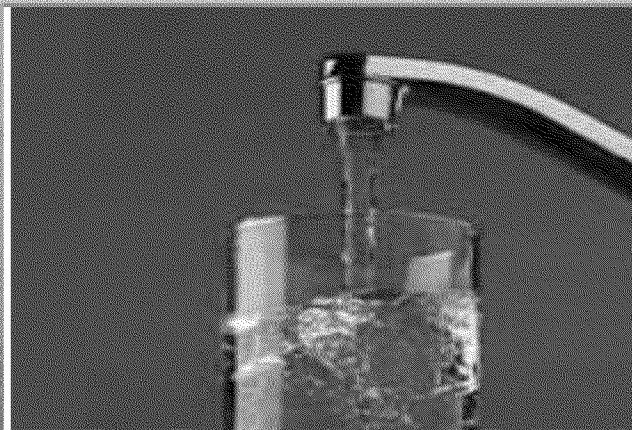
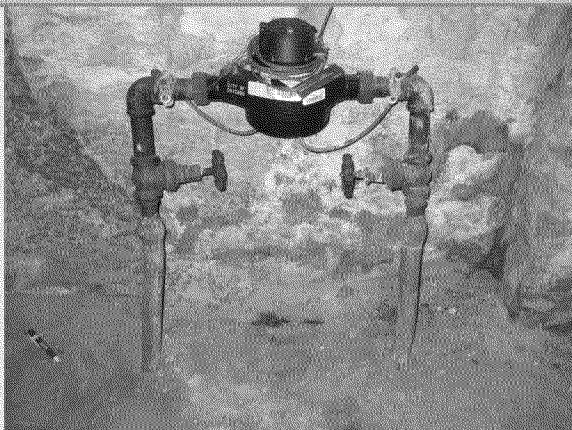
Chicago, IL 60604

Phone: 312-886-4427

Fax: 312-697-2656



Office of Research and Development



Assessing Lead in Drinking Water: Sampling, Treatment, and Regulatory Limitations

Michael R. Schock

Treatment Technology Evaluation Branch
Water Supply & Water Resources Division
National Risk Management Research Laboratory
USEPA Office of Research and Development
Cincinnati, OH



Disclaimer

The information in this presentation has been reviewed and cleared for public dissemination according to EPA policy. Mention of trade names or commercial products does not constitute EPA endorsement or recommendation for use.

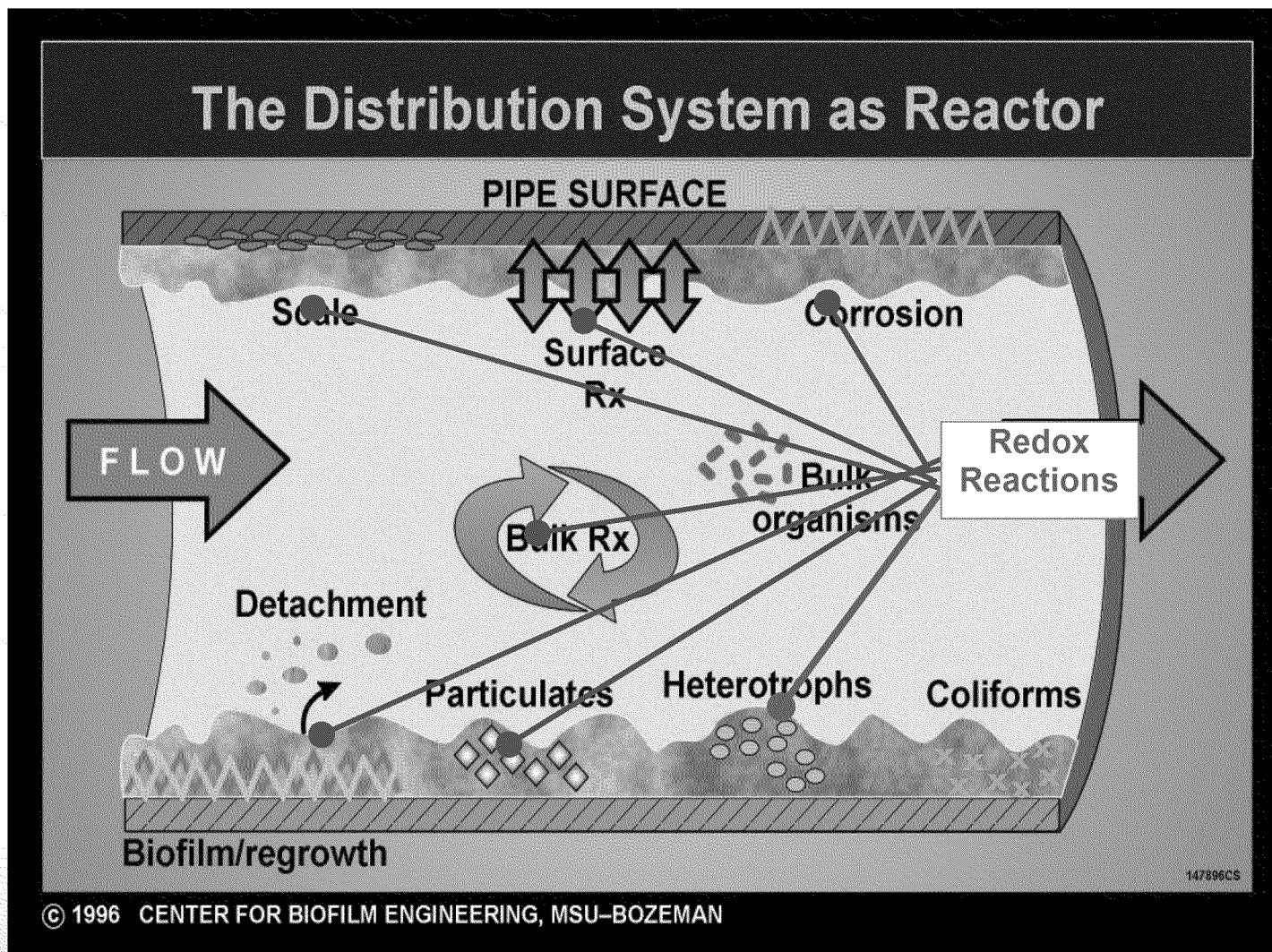


Main Points

- Corrosion, metal release, and transformation in the distribution system to tap
- Sources of lead in household plumbing
- Intentional central water treatment approaches for lead release control, and some accidental deposits that influence it
- Two minute overview of the Lead and Copper Rule and why it should NOT be assumed to be protective
- Diagnostic sampling approaches to identify sources
- Thoughts on approaching exposure evaluation



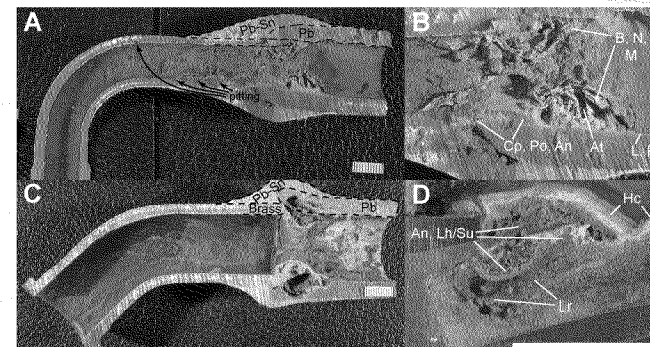
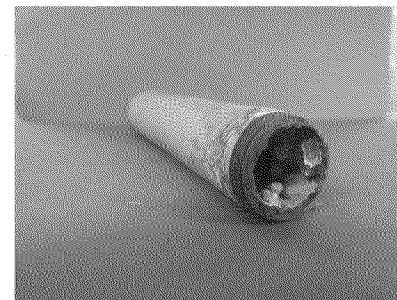
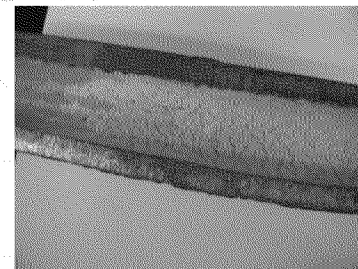
DS = A Long Longitudinal Reactor

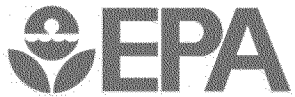




Types of Corrosion of Concern

- **Uniform corrosion**
 - Materials degradation
 - Metal release (Pb, Cu, etc.)
- **Non-uniform corrosion**
 - Pinhole leaks (copper)
 - Dezincification
 - Tuberculation (iron, galvanized steel, brass)
- **Galvanic**
 - Soldered joints
 - Brass devices
 - Coupling of different pipe materials





Factors Governing Lead Levels

- Sampling protocol
- Intrinsic Pb solubility of surface material (water chemistry)
- Rate of dissolution in short stagnation times
 - Galvanic driving force (different metals, brass, solder)
 - Diffusion from surface (reaches steady state)
- Length of contact with lead source
- Nature of lead release
 - Particulate
 - Soluble

Additional point: There are no “corrosion indices” or surrogate pipe rigs that can take the place of directly monitoring lead release.

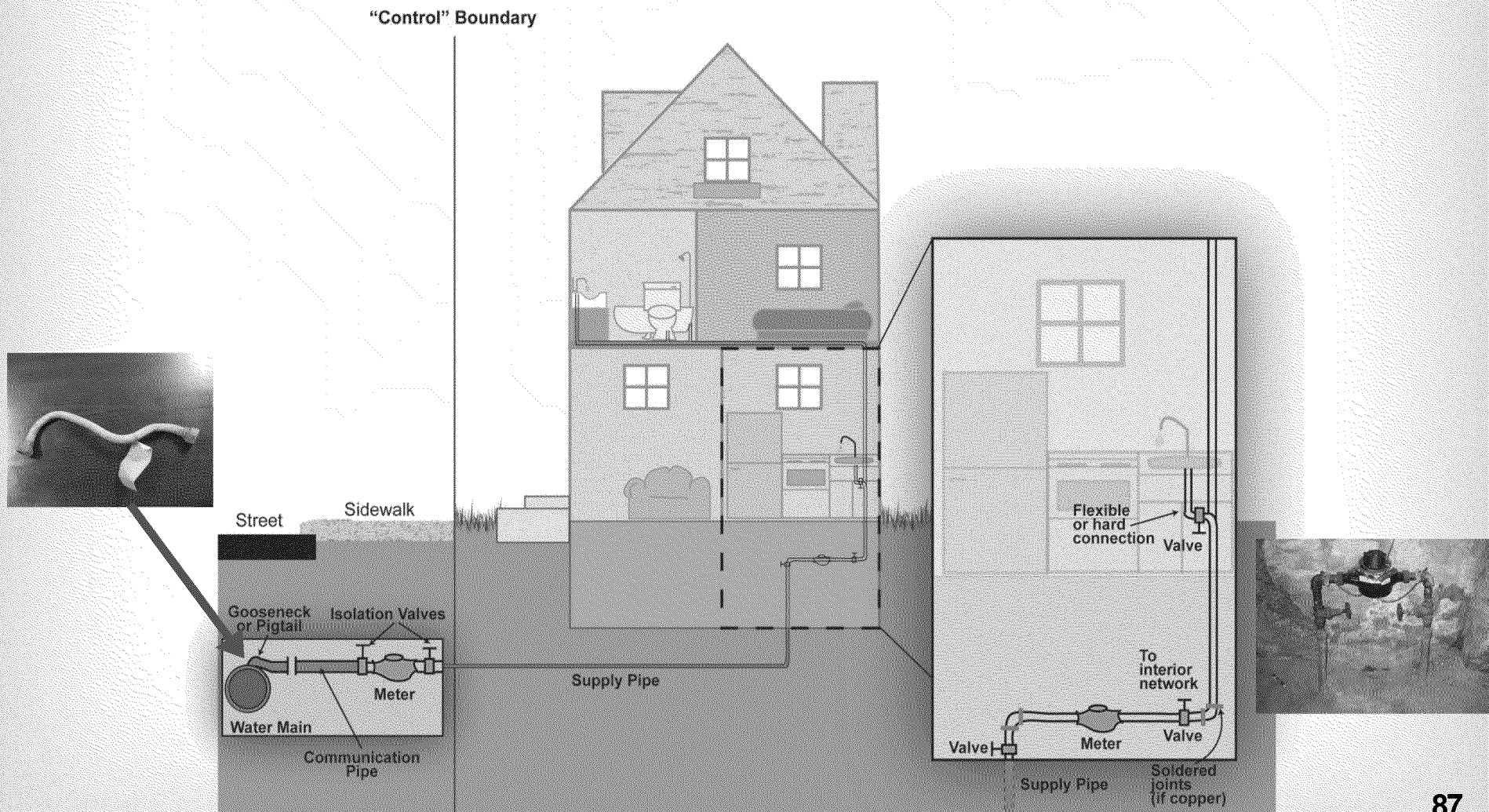


Many Places to Find Lead in Household Plumbing





Typical Household Pb Sources





“Ownership/Control” Situation 1

Scenario 1:

Only the portion of the service line from the water main to the external shut-off valve or property line is made of lead.

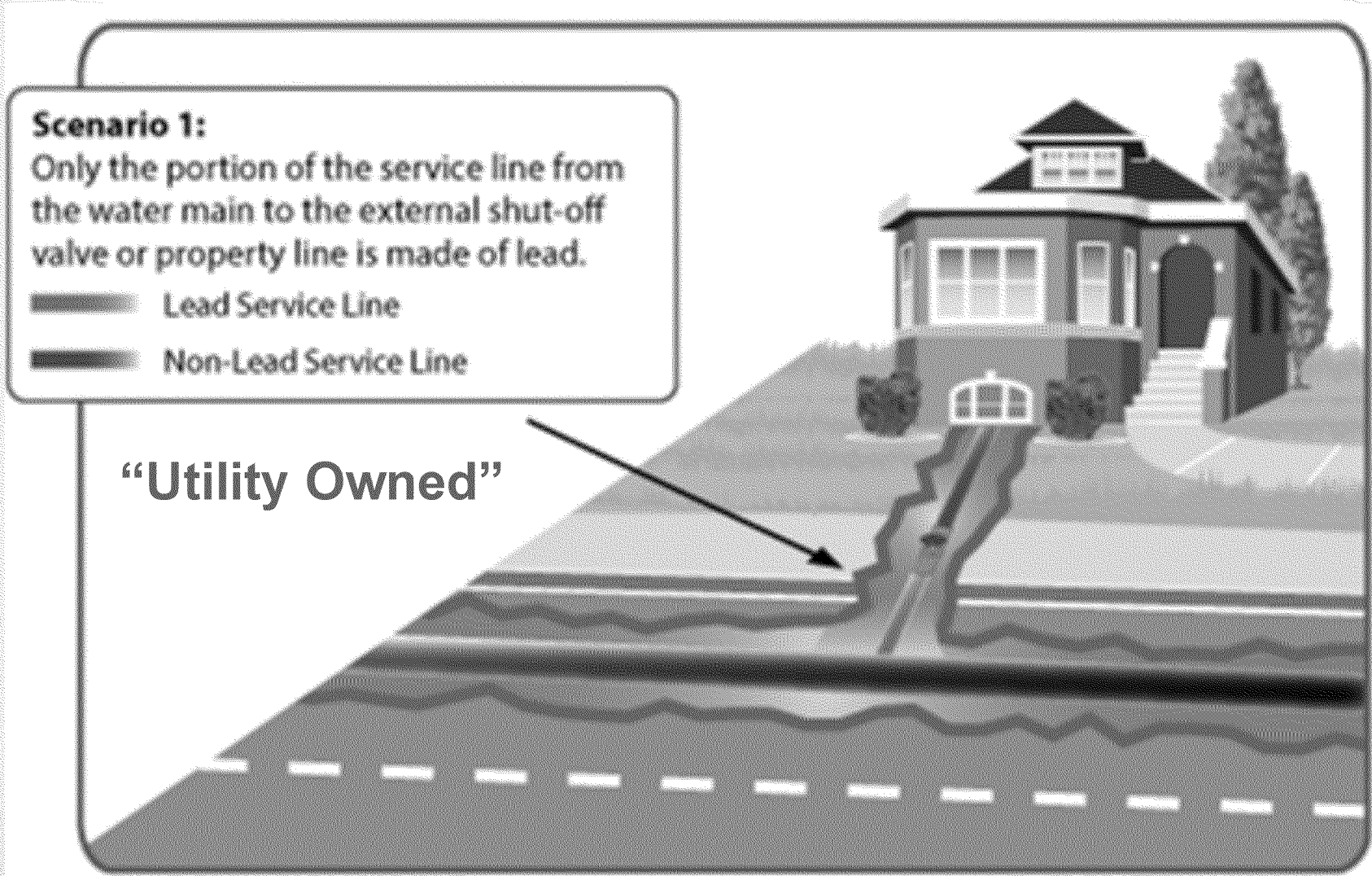
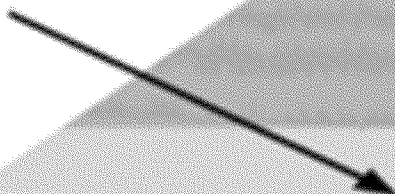


Lead Service Line



Non-Lead Service Line

“Utility Owned”





“Ownership/Control” Situation 2

Scenario 2:

Only the portion of the service line from the external shut-off valve or property line to the interior plumbing is made of lead.



Lead Service Line



Non-Lead Service Line

“Property Owner
Owned”





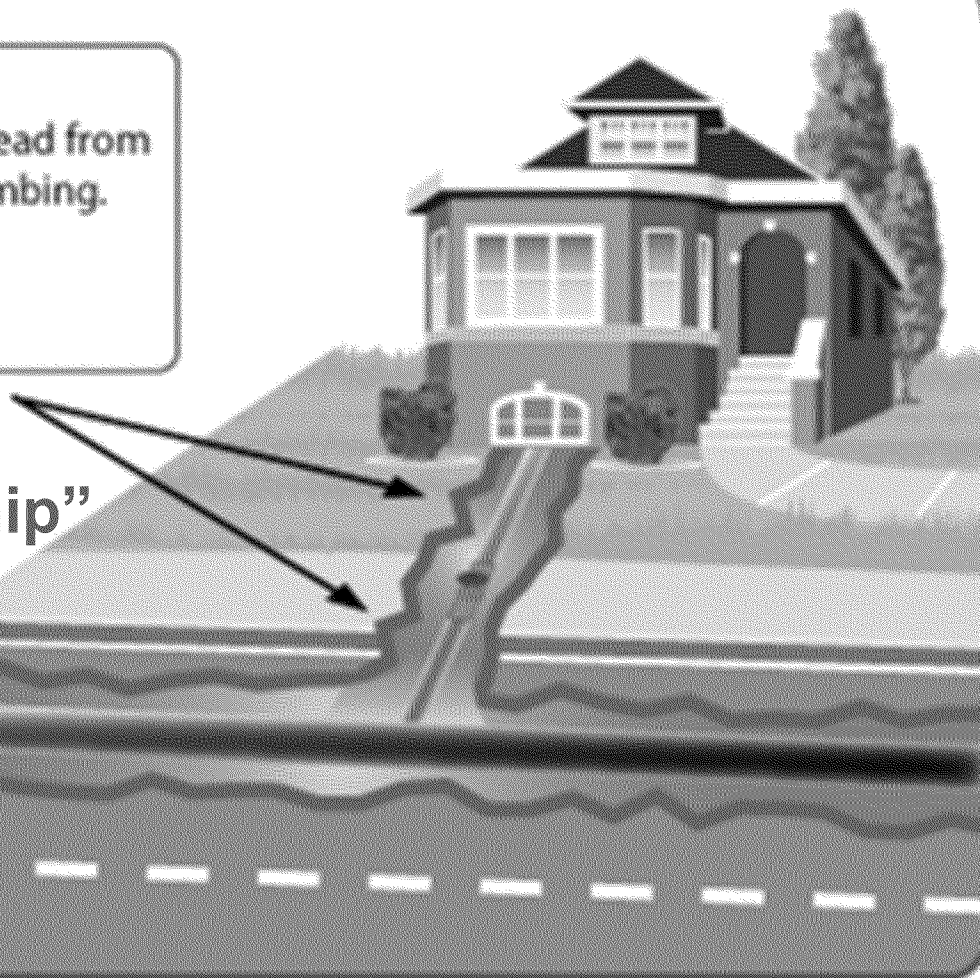
“Ownership/Control” Situation 3

Scenario 3:

The entire service line is made of lead from the water main to the interior plumbing.

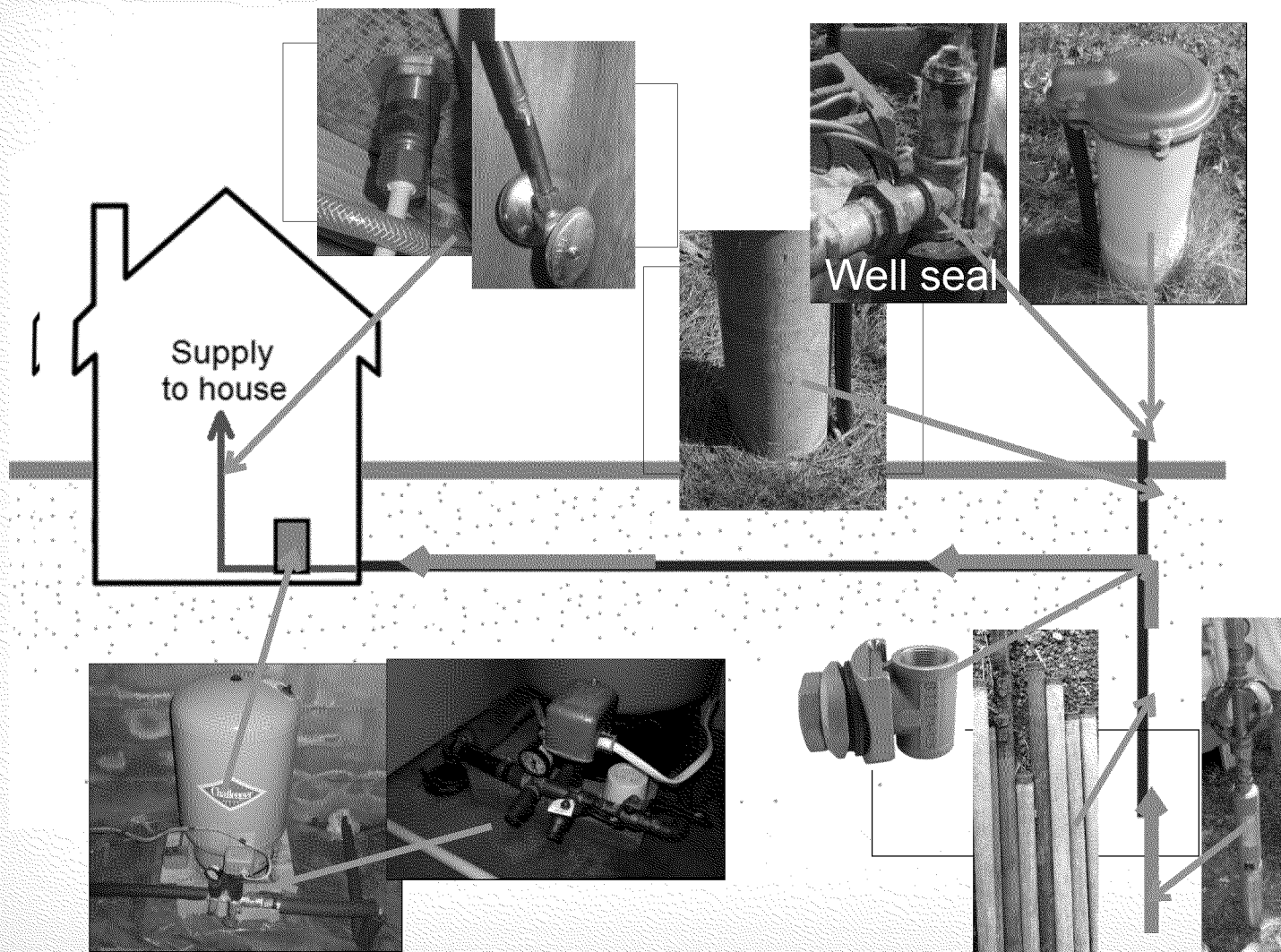
Lead Service Line

“Mixed Ownership”
= Shared
Responsibility





Private Water System Pb Sources



Courtesy: Kelsey Pieper, UNC



Main Connection through Curb Stop





Two Problems at Once: Galvanic Corrosion and LSL Disturbance!!

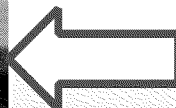




Examples of Service Line Replacement



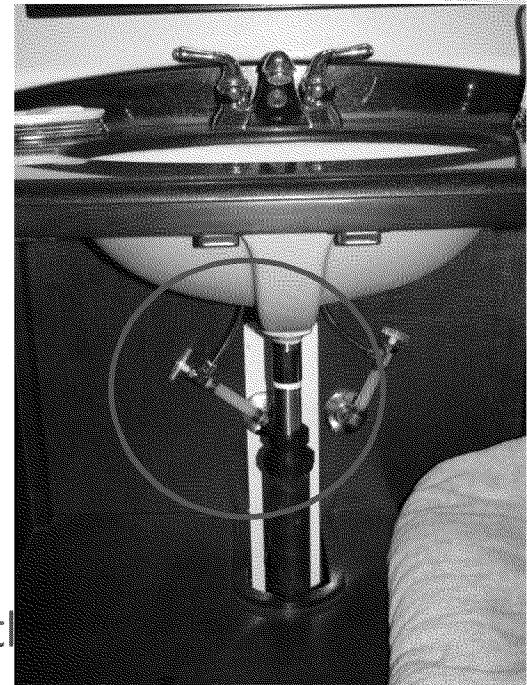
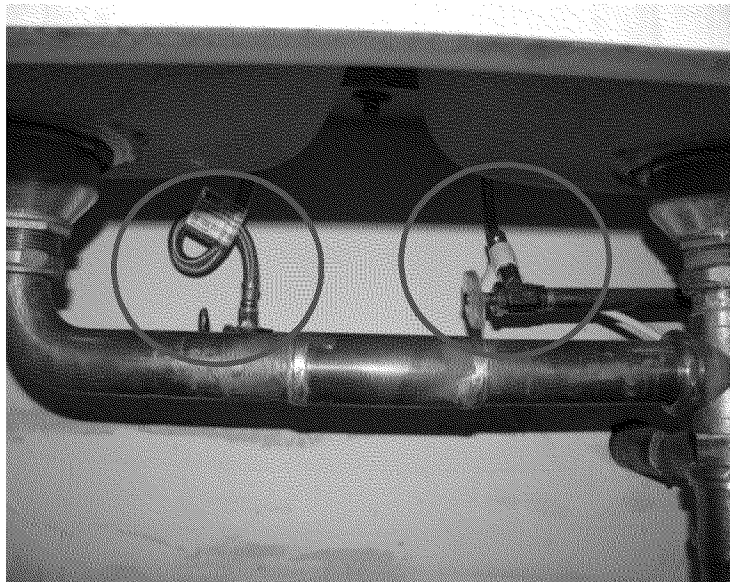
Copper replacing steel



Lead (before replacement)



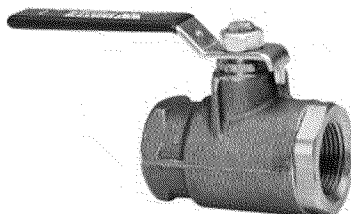
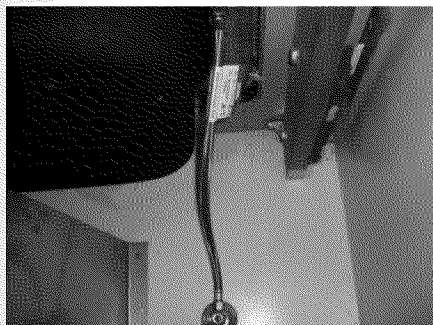
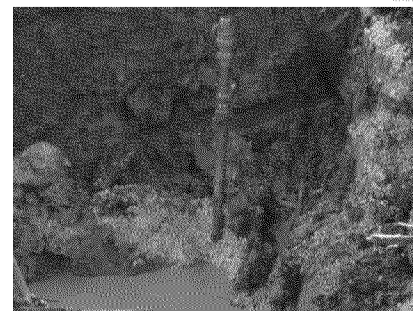
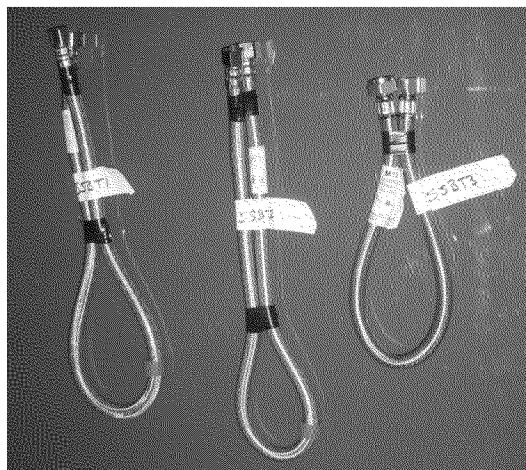
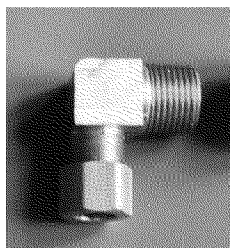
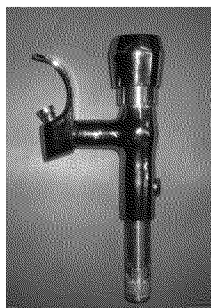
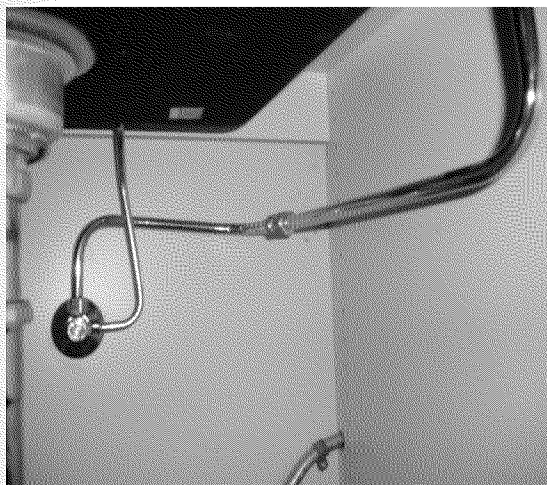
Valves Often Are Overlooked When Focus is on Faucets



- Shut-off valves frequently captured in 250 mL to 1 L samples
- Often not certified ANSI/NSF Section 9



Lead Sources Are Often Hidden





Characteristics of Pb Sources

- When present, LSL is biggest reservoir of Pb, but may not always be highest spike or peak value
 - Dislodged particles
 - PbO₂-LSL scale systems may have higher Pb from brass fixtures and fittings
- Pb sources within housing and buildings
 - Numerous hidden locations (behind walls, under floors, etc.)
 - Small lateral extent in each occurrence
 - May be located considerably distance from consumption tap
- Sampling instruction details matter
 - Random use pattern presumed by LCR
 - Pre-flushing all but eliminates detecting LSL contribution
 - Water use *prohibited from tap* is different from
 - Water use *prohibited from house/feed line*



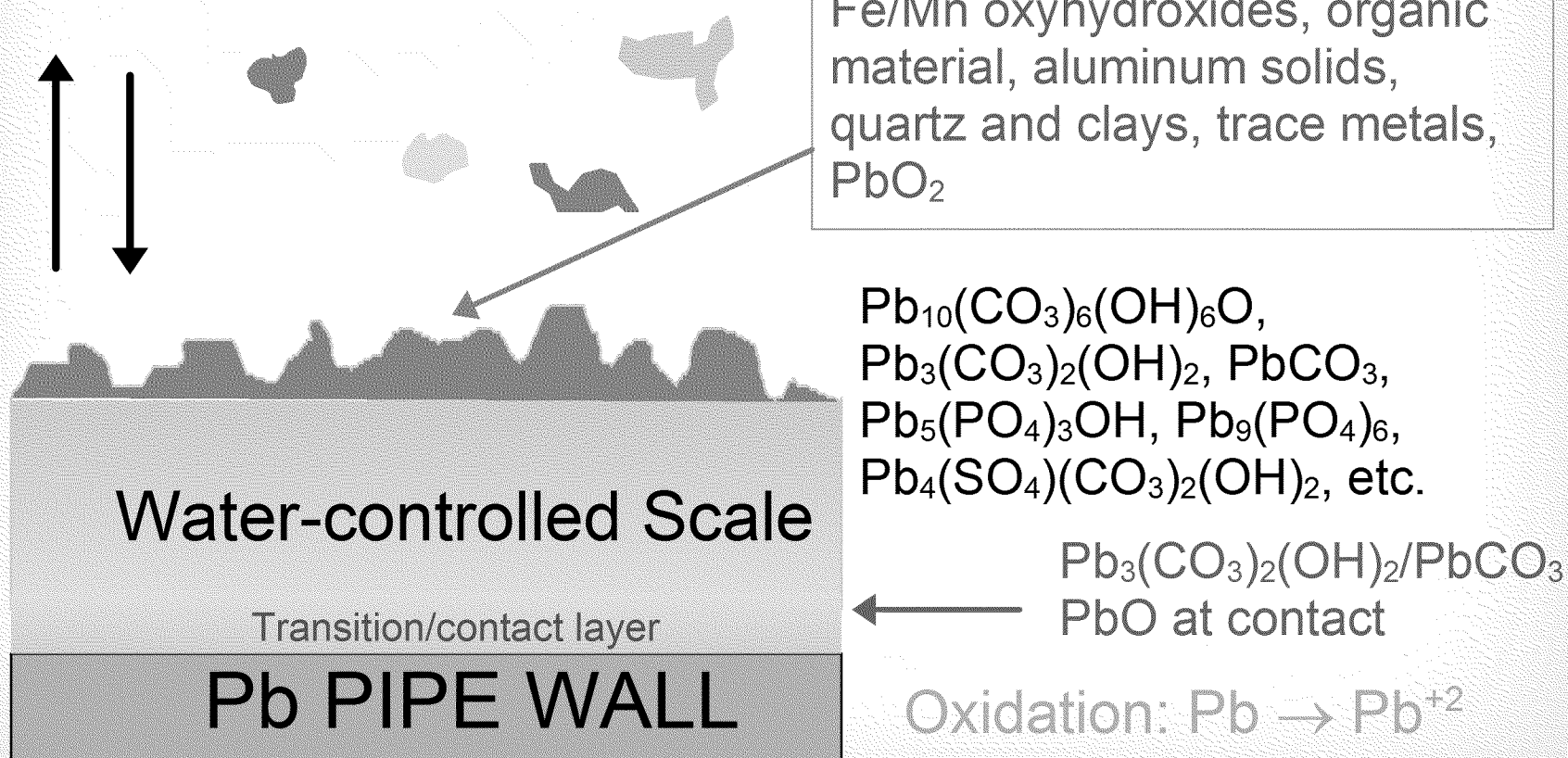
Accidental or Intentional Treatment to Immobilize Lead Release





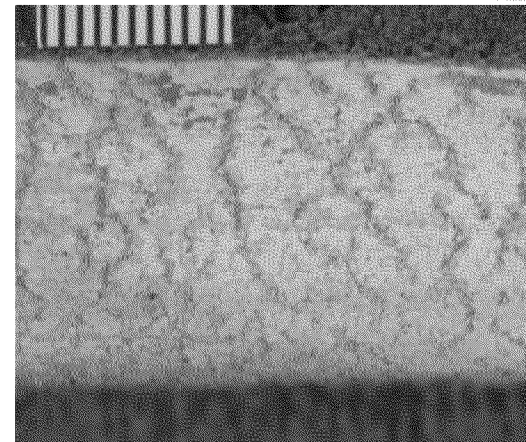
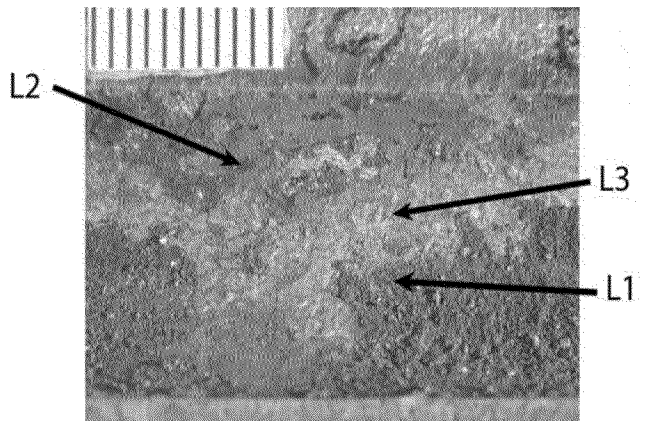
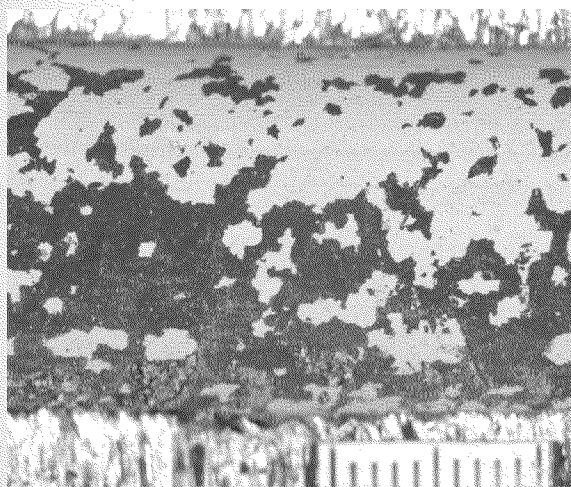
Typical Pb(II) Scale X-section

Soluble Metal (Exaggerated vertical scale!)





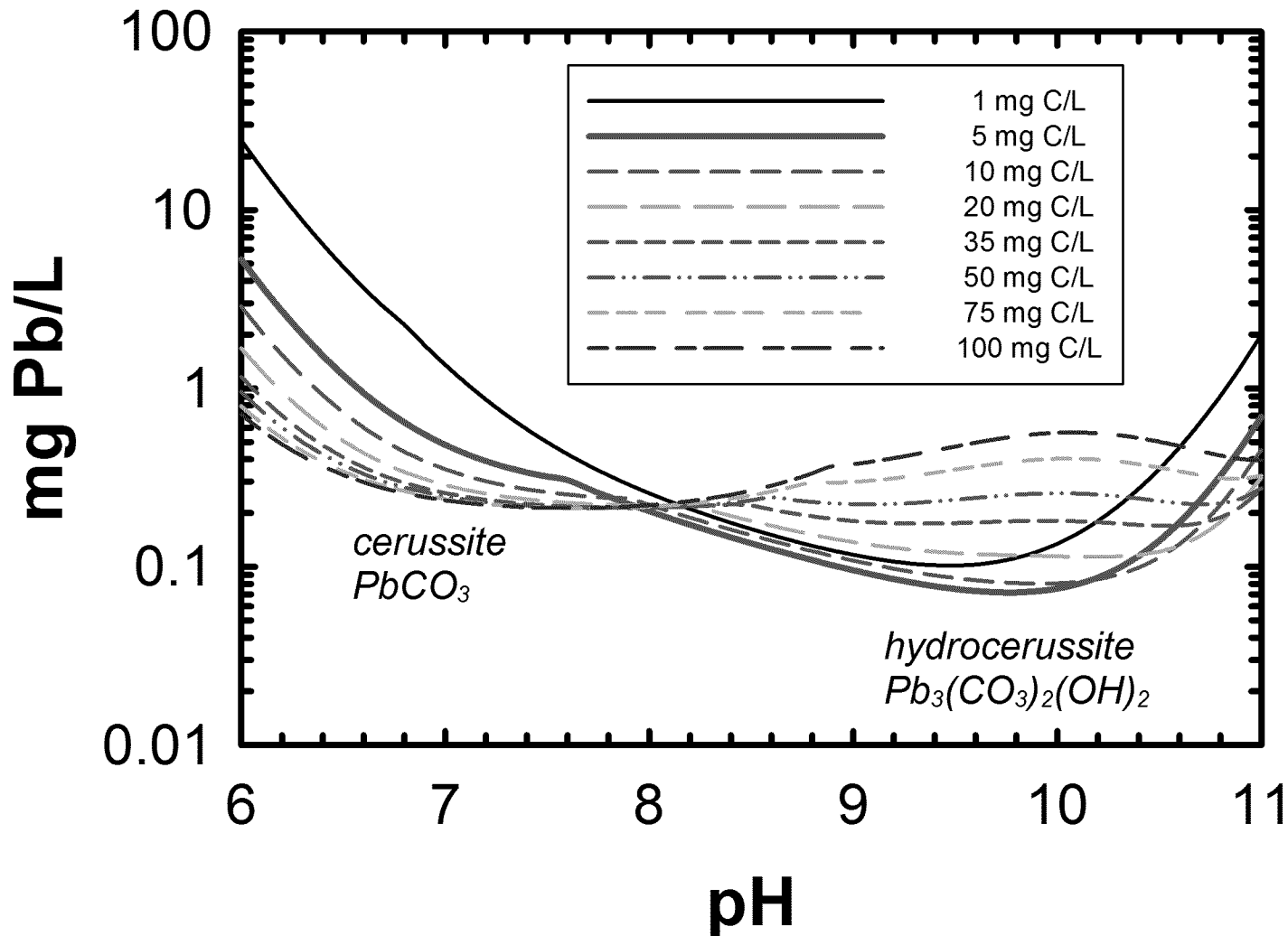
Only some LSL scales are simple





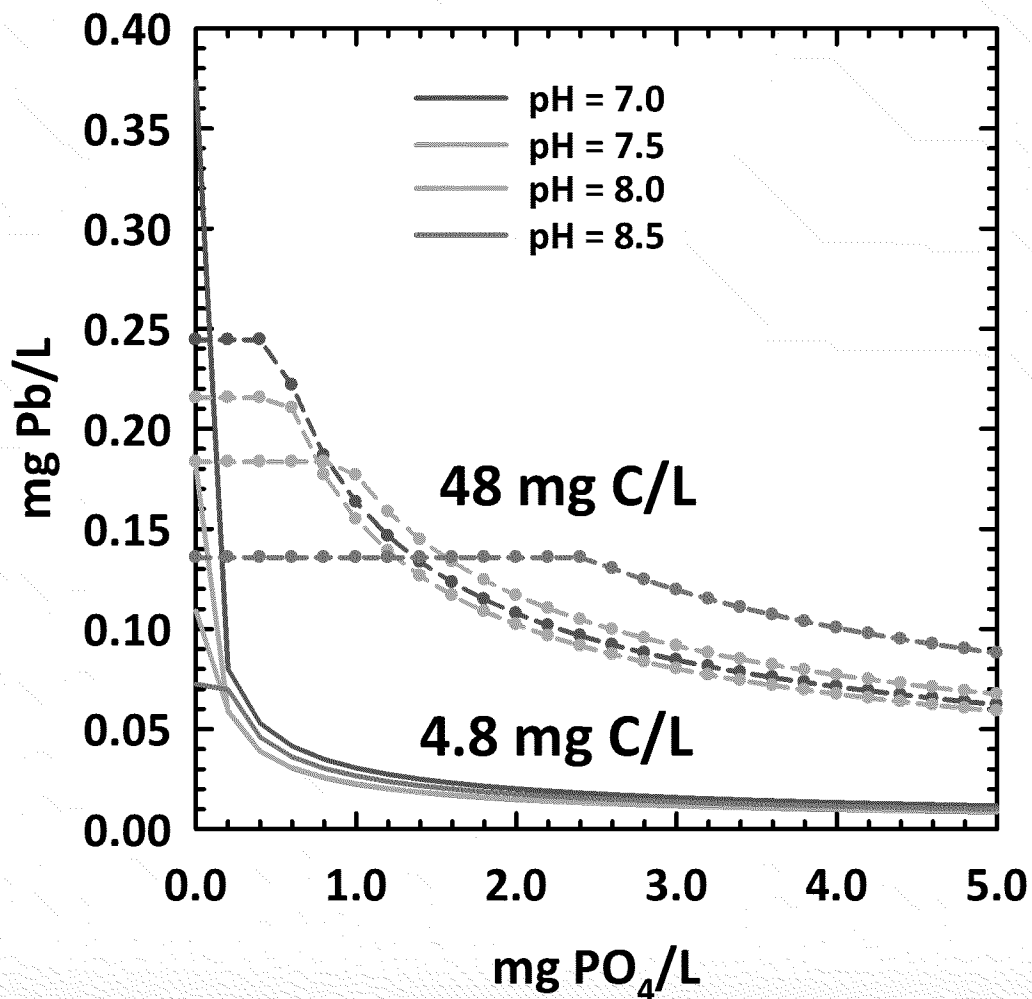
Effect of DIC and pH on Pb(II) Soly.

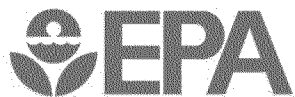
$$\text{DIC} = [\text{H}_2\text{CO}_3^*] + [\text{HCO}_3^-] + [\text{CO}_3^{2-}]$$



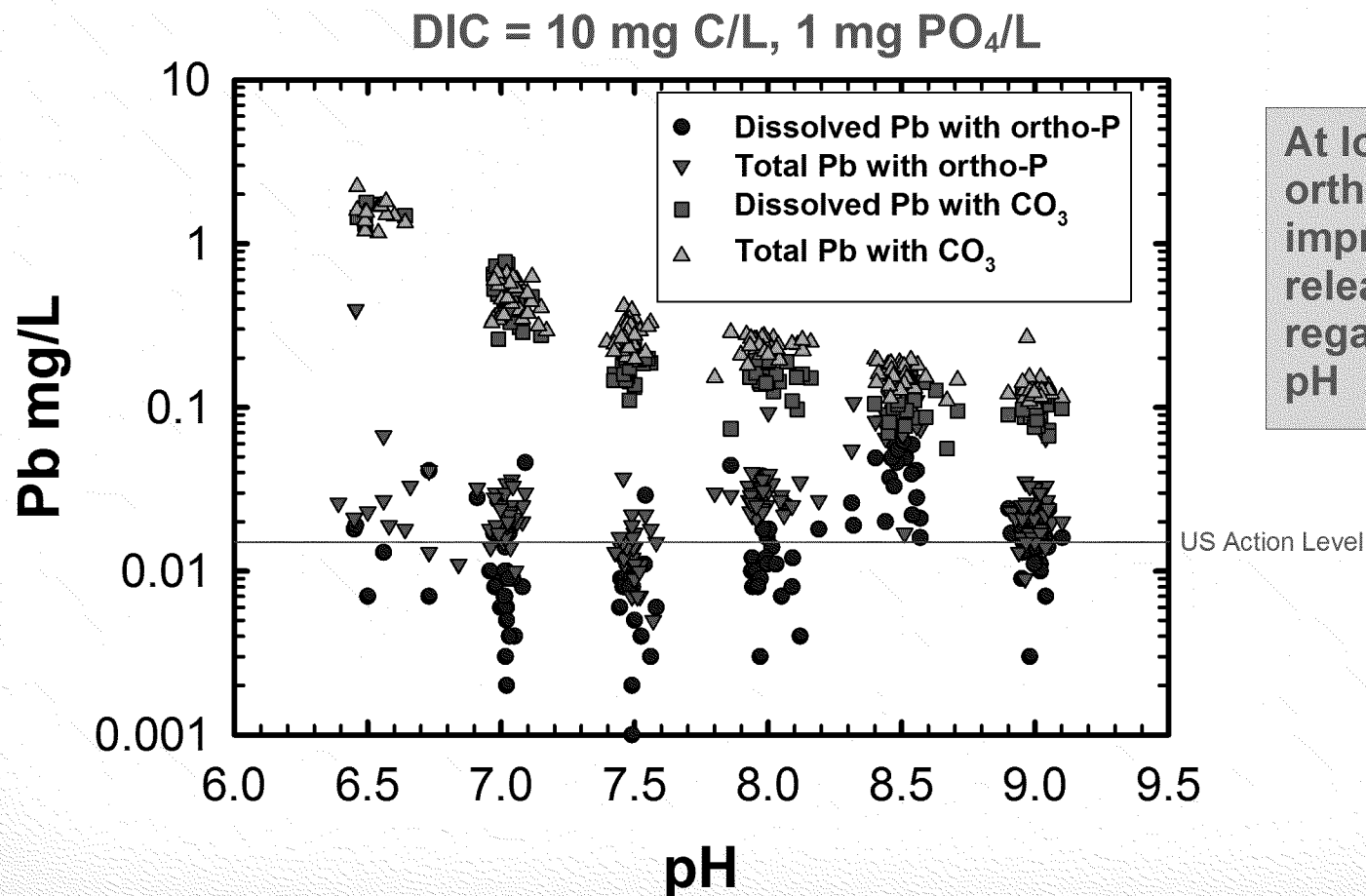


Pb(II) Solubility is Reduced by Orthophosphate (also with soils)





Effect of pH and PO_4 on Pb Release



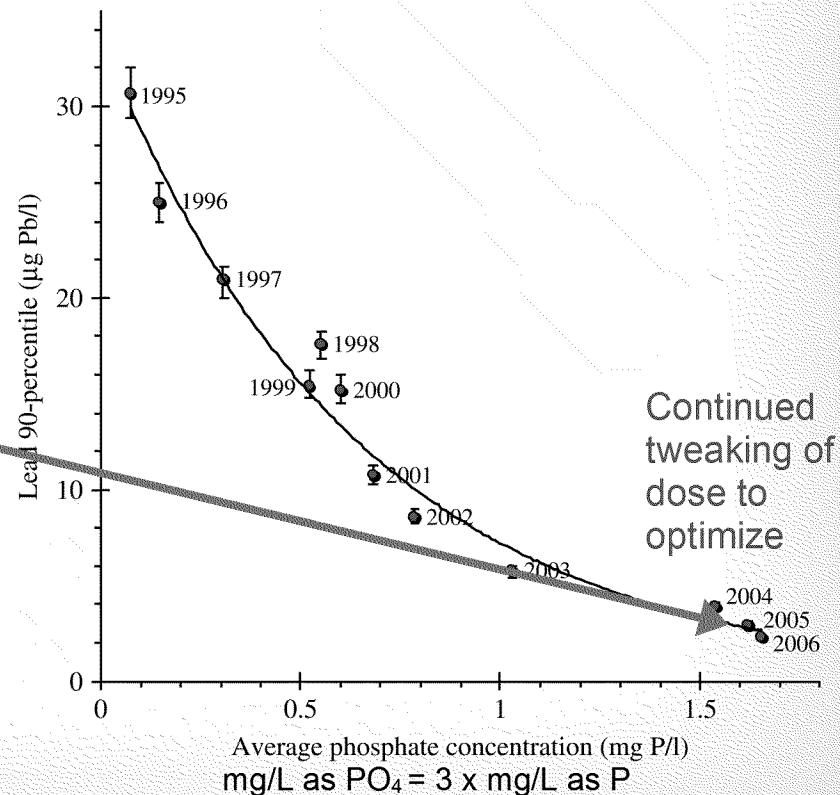
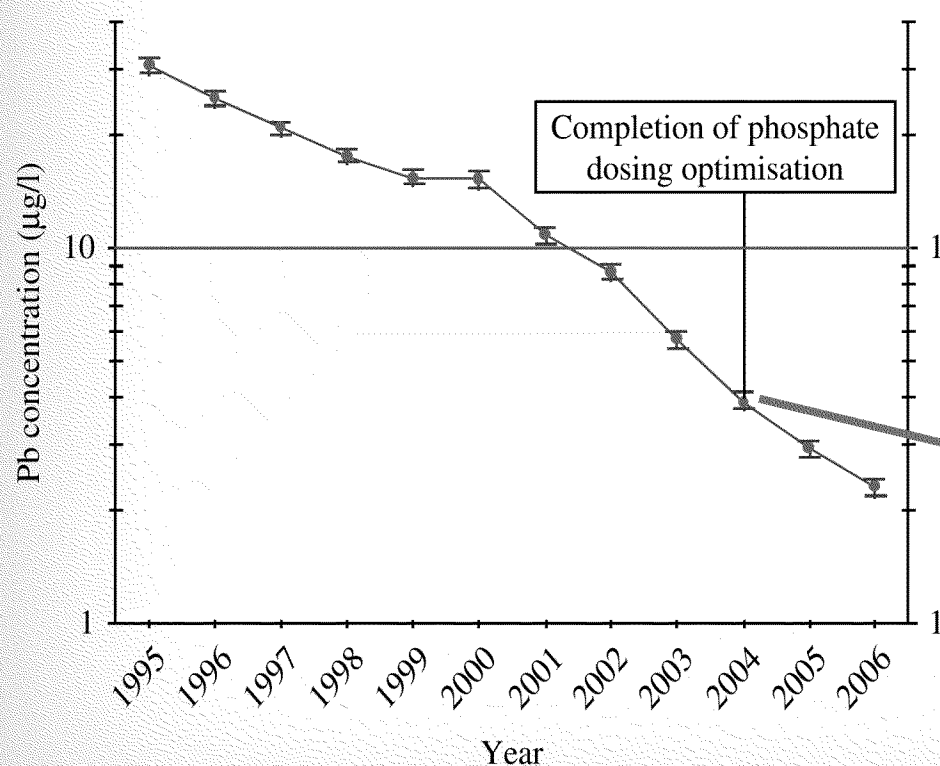
At low DIC,
orthophosphate
improves lead
release
regardless of
pH

Schock, M. R.; DeSantis, M. K.; Metz, D. H.; Welch, M. M.; Hyland, R. N.; Nadagouda, M. N. *Revisiting the pH Effect on the Orthophosphate Control of Plumbosolvency*, Proc. AWWA Annual Conference and Exposition, Atlanta, GA, **2008**.



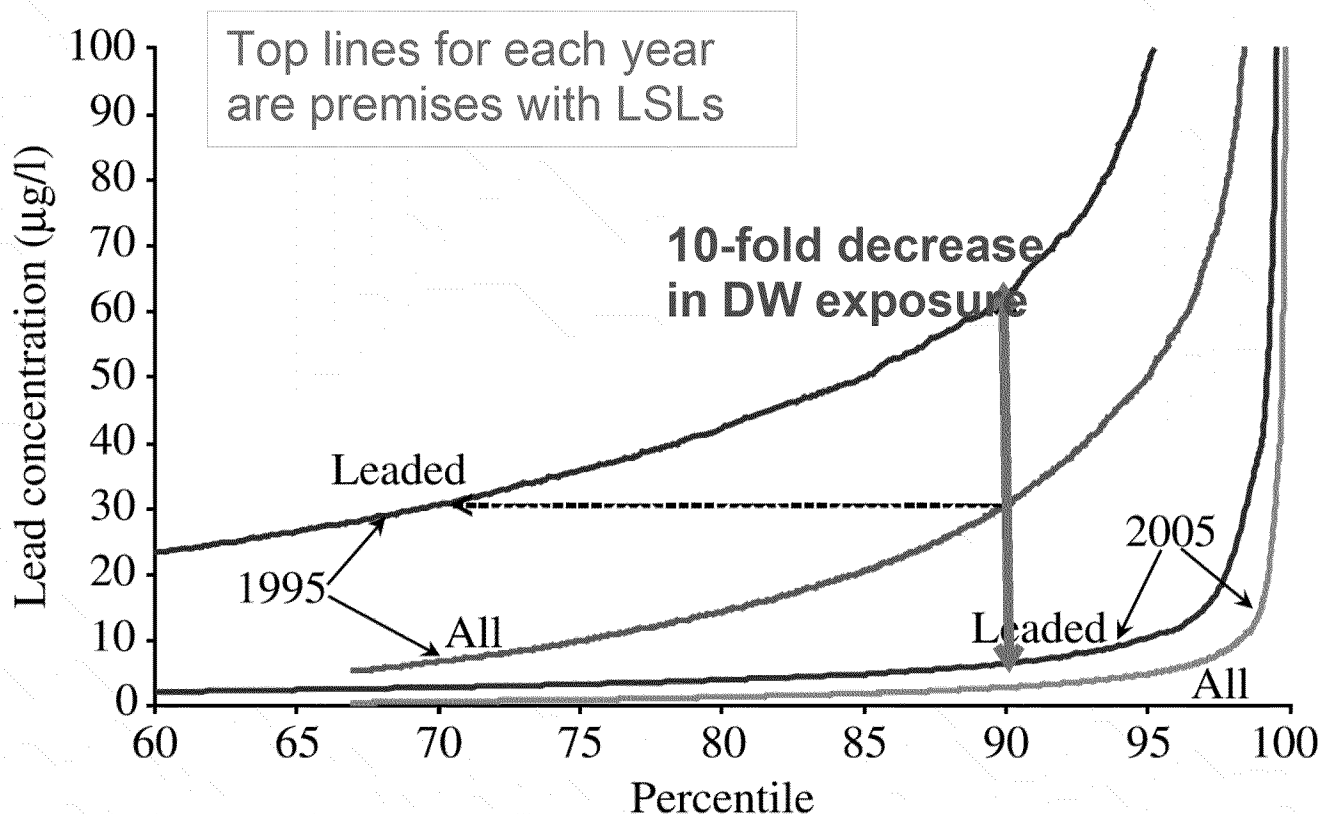
Treatment Works on Both Soluble & Particulate Release

Aggregated UK Monitoring Data: Used two-pronged approach:
(1) Initial dose estimation by pipe rig study for background water
(2) RDT tap monitoring to assess progress & exposure





UK Decade of Pb Optimization Progress for Both LSLs and Other Pb Sources



Cardew, P. T. Measuring the benefit of orthophosphate treatment on lead in drinking water. *J Water Health* **2009**, 7 (1), 123-31.



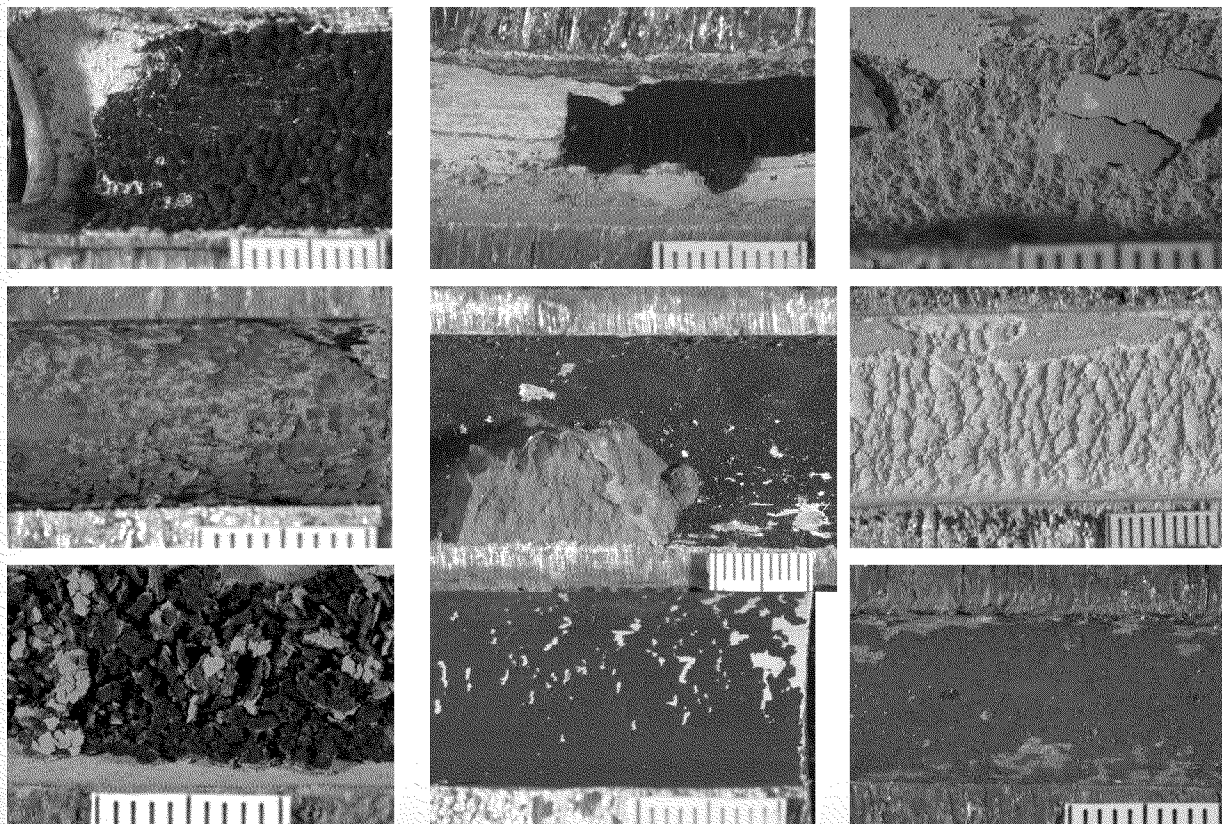
There Are Many Types of Scale on Pb Pipe

- Simple carbonate or hydroxycarbonate Pb(II) mineral
- Simple Pb(II) orthophosphate mineral
- Simple PbO₂ solid phase, by itself or mixed with Pb(II) phases
- Mix of Pb(II) phases
- Protective “diffusion barrier” materials
 - Could be insoluble amorphous Pb(II) phase
 - Adherent non-Pb phase
- Surface fouling deposit
 - Primarily not made of lead, usually not crystalline
 - Lead may sorb to surface
 - Often not adherent



Many LSL Scales Are Mixtures of Solids

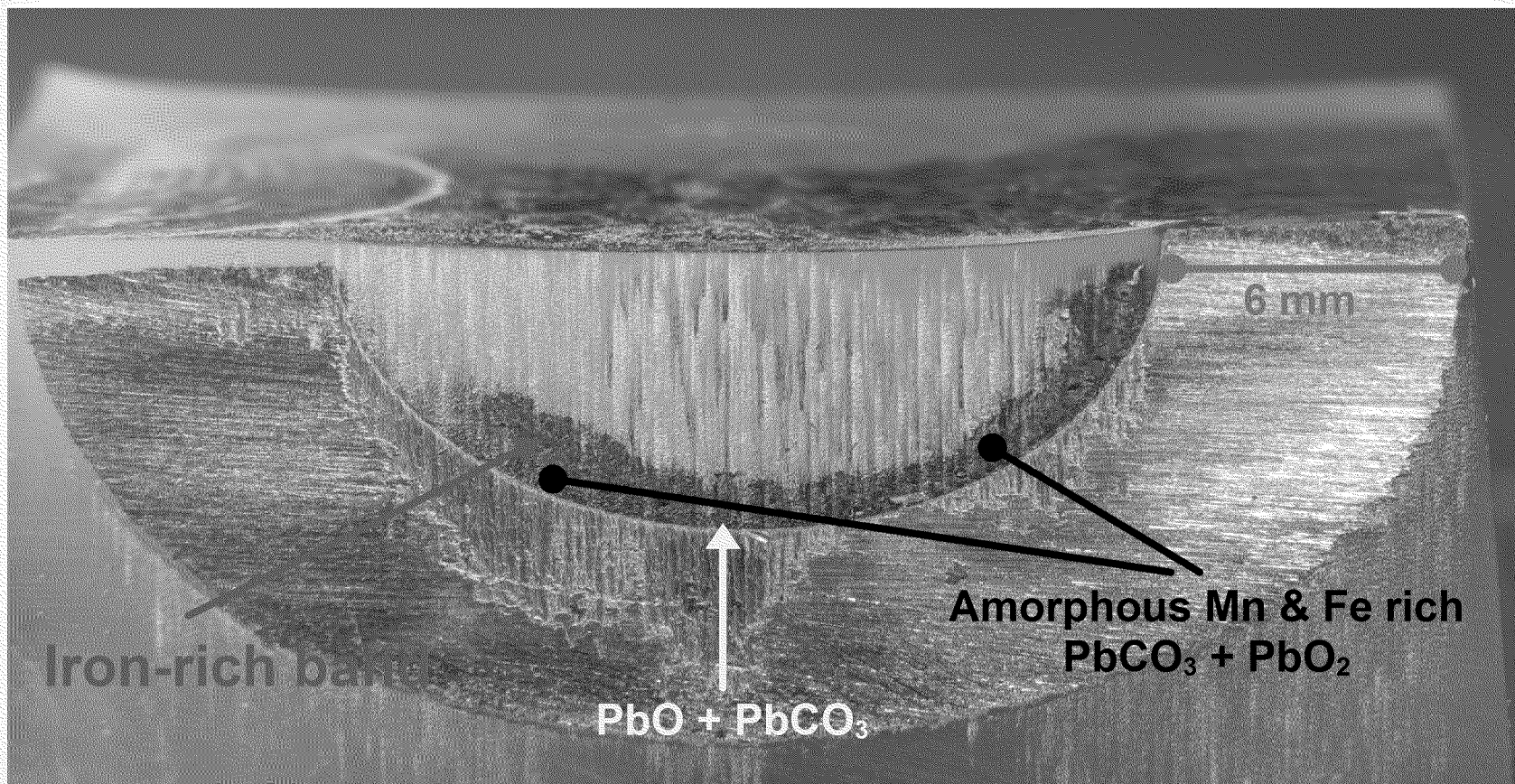
18 of 52 DWDS studied by EPA show external layer deposits almost completely made of poorly crystalline Mn, Fe, Al, Ca, or Si-rich phases



Adding orthophosphate or just adjusting pH with thick coatings likely will not minimize lead release until causes of the interfering buildups are controlled

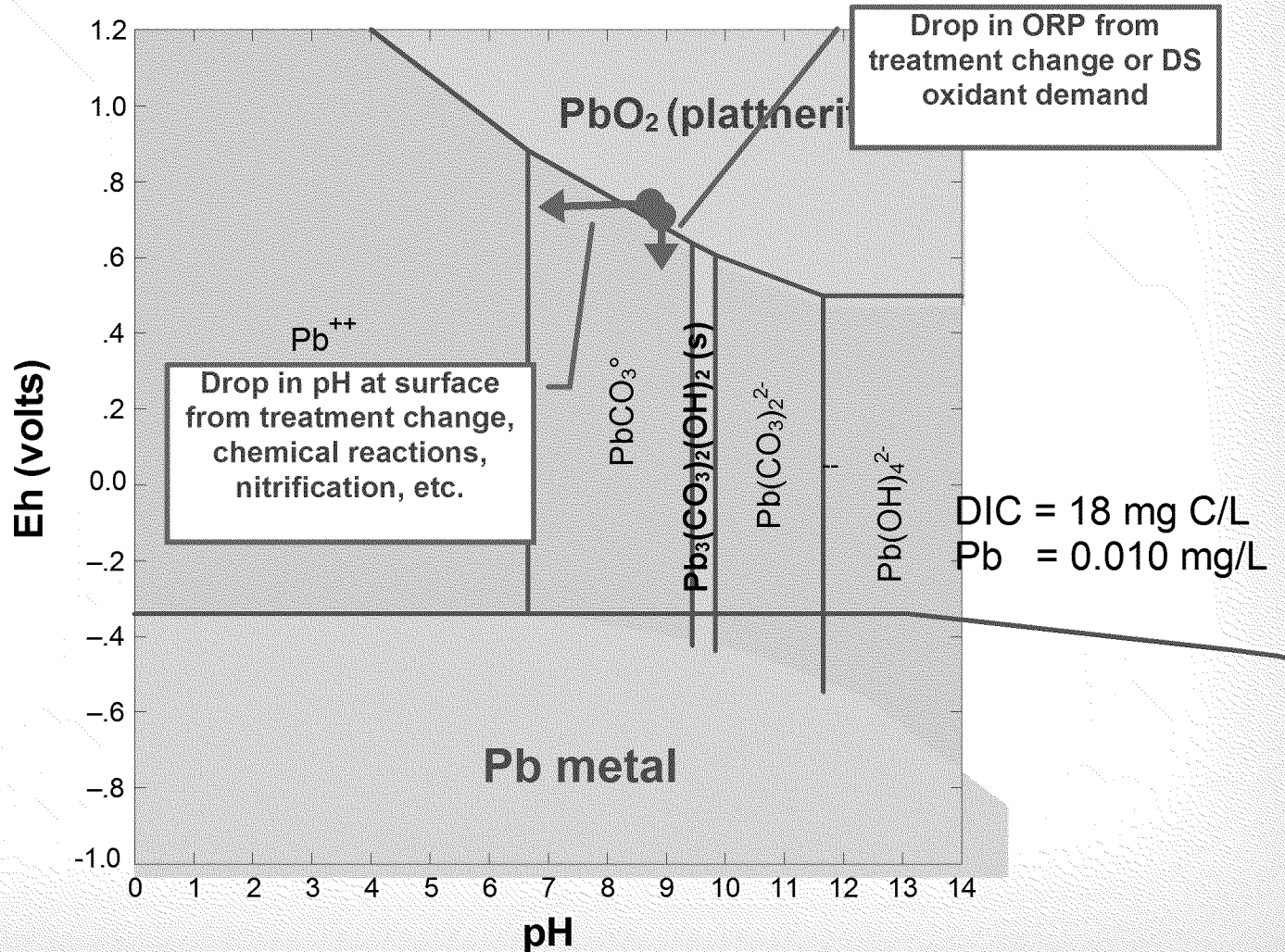


Layering from ORP-Induced Deposition





Protective PbO_2 May Form at High ORP



Disinfectant demand in DS must be controlled and enough free chlorine consistently maintained throughout LSL area

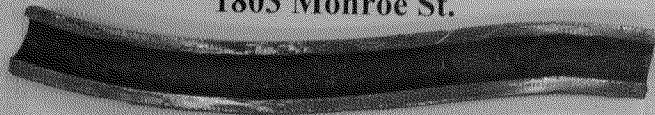


Examples of Protective PbO_2 Scales

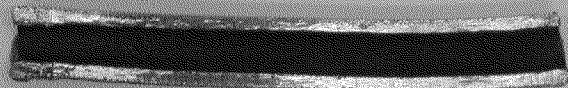
WASHINGTON, DC
Lead Service Line (c. 1926/8-2004)



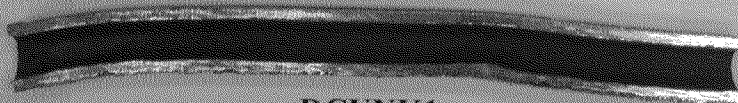
1803 Monroe St.



1335 Hemlock St. NW

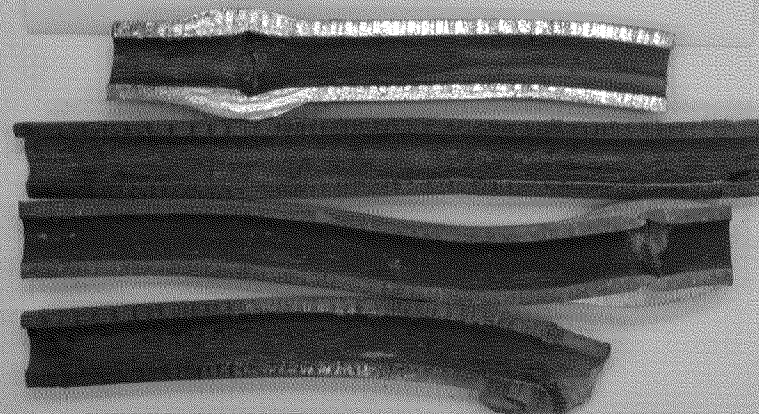


1340 Hemlock St. NW



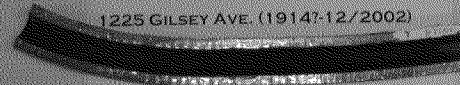
DCUNK1

Oakwood, Ohio
Lead Service Lines (rem. 2002)



CINCINNATI, OH
LEAD SERVICE LINE

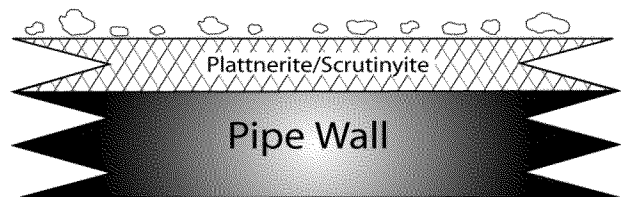
1225 GILSEY AVE. (1914/7-12/2002)



119 CATALPA RD. (1925/7 - 1/24/03)

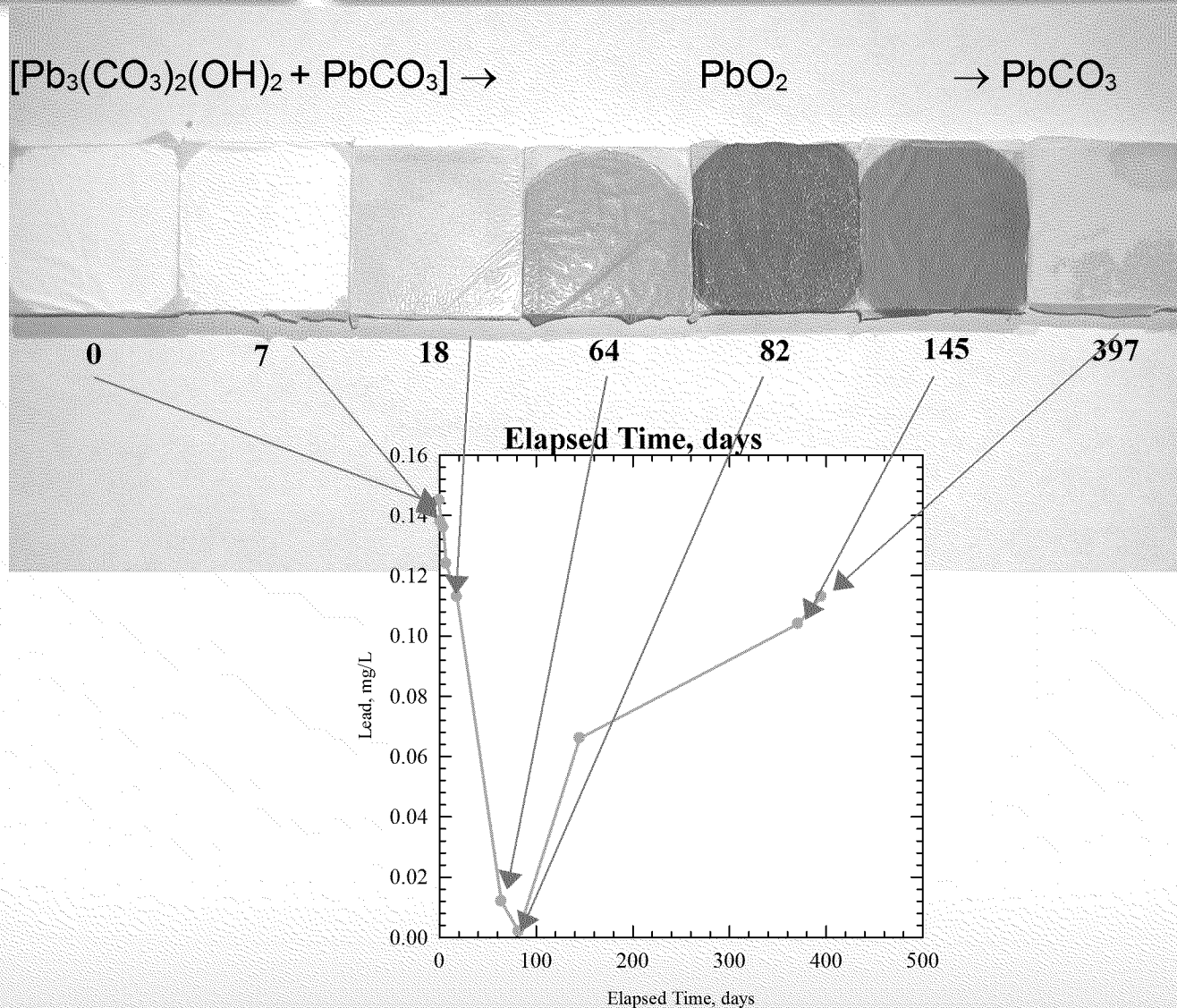


3030 JUNIETTA AVE. (1930/7 - 1/24/03)



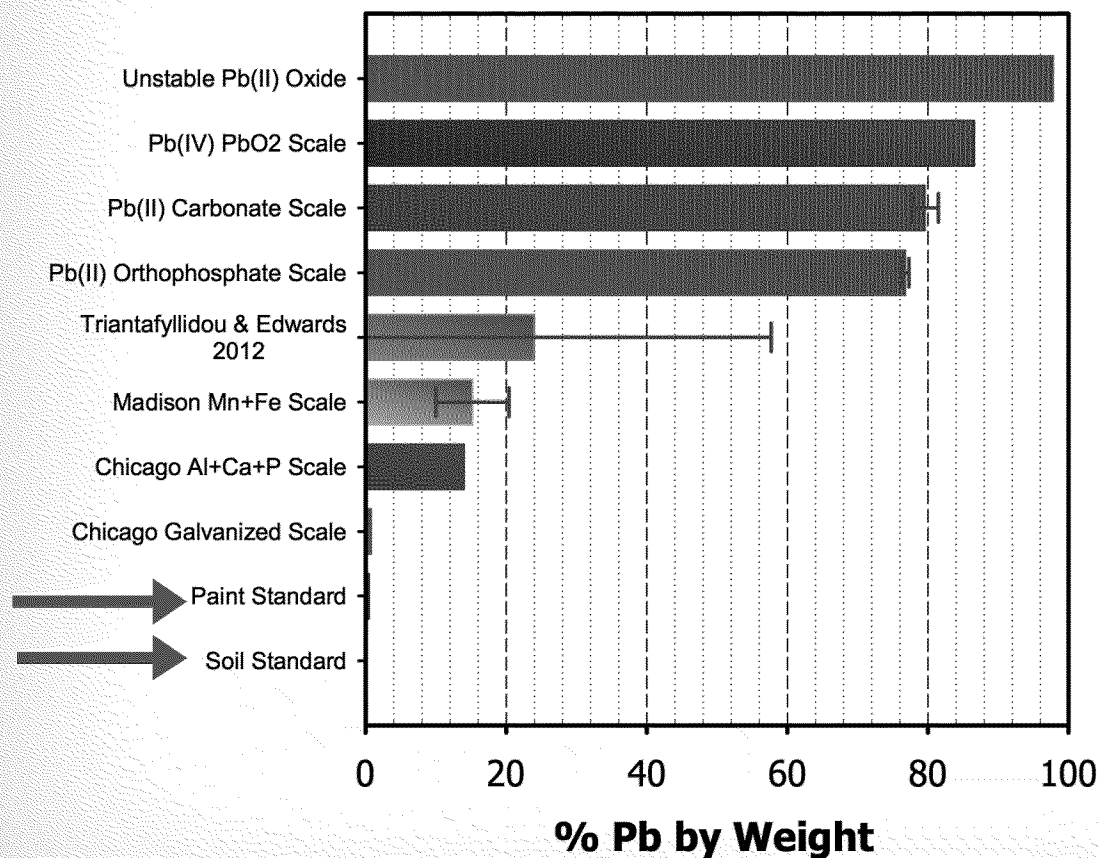


PbO₂ Scales Can Deteriorate if ORP Drops





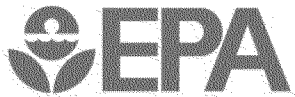
Drinking through Lead-Painted Pipes



Pipe scale particles have as much or more lead than Pb in paint or soil and is absorbed into food and concentrated, as well as directly ingested from water or beverages

Erosion and suspension of particles from pipe corrosion scales and deposits is inevitable.

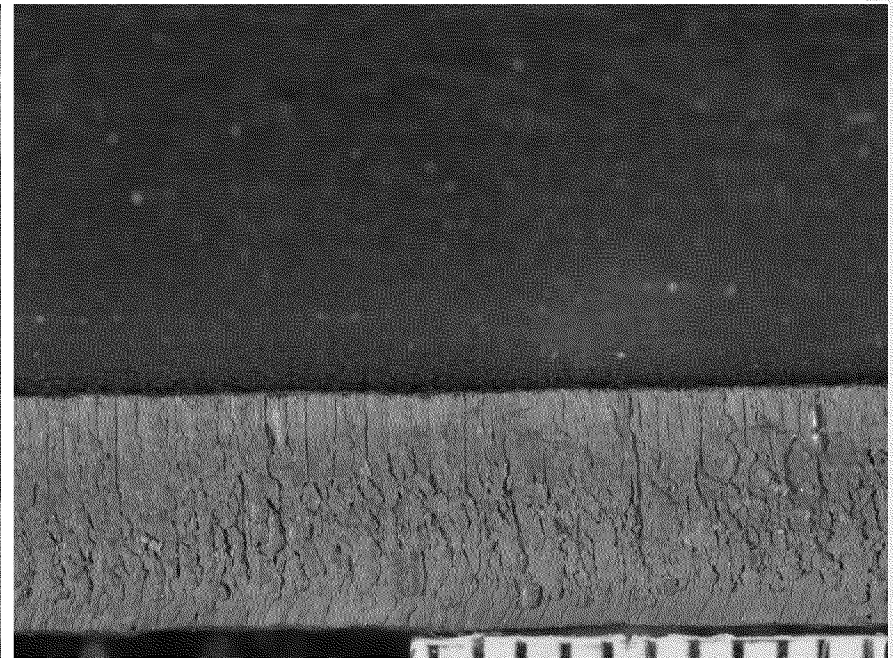
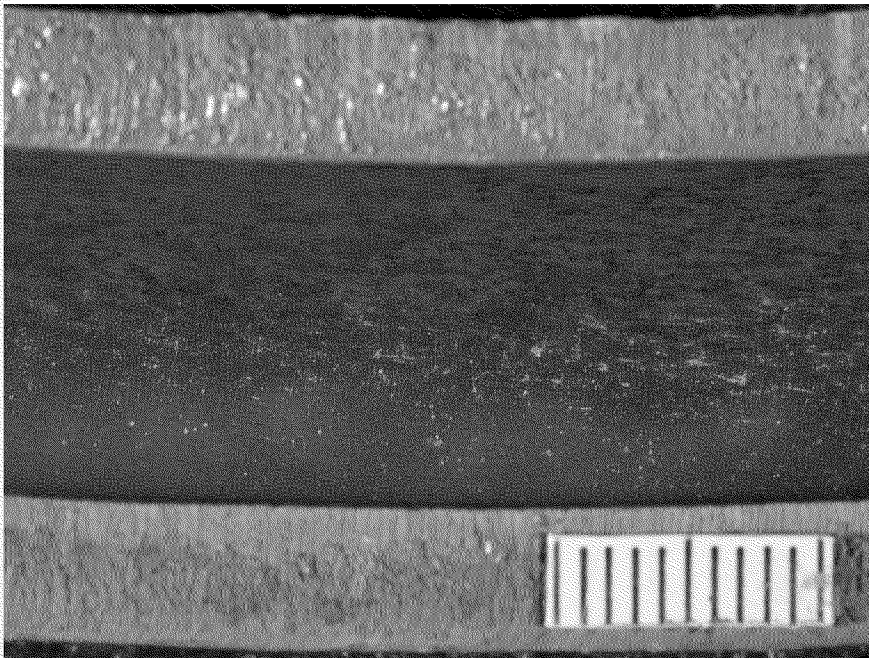
Even minute amounts are greater relative exposure than paint or soils



Lead Pipes Are Forever.... (Need to Be Removed)

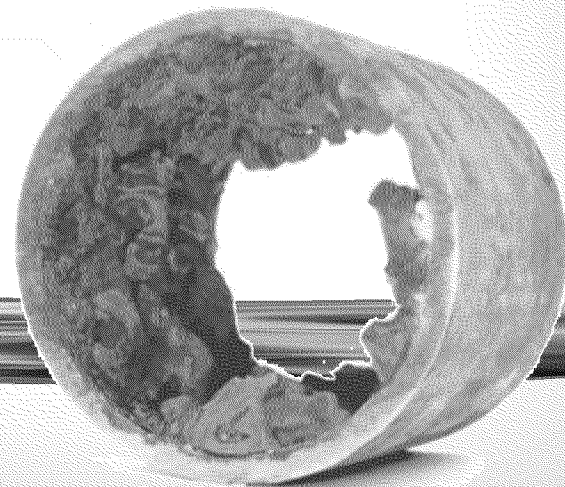
Lead Pipes Won't Go Away Any Time Soon

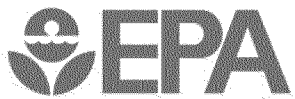
Installed Right After the Civil War 150 Years Old in Cincinnati: Any Signs of Failure?





The “Lead and Copper Rule” (LCR)





LCR Basic Framework: PWS ONLY

- 90th percentile Action Level IS NOT A HEALTH-BASED NUMBER
- Number is based on 1990 state of the art estimate of treatment “feasibility,” adjusted for system size
- Large systems required to “*minimize*,” not just meet AL
- AL triggers actions
 - More monitoring
 - Public Education
 - Treatment studies/implementation if not already doing so
 - Utility-owned lead service line replacement
- No violations attached to high Pb levels
- Violation/compliance mechanism is only monitoring and maintenance of “Optimal Water Quality Parameters”



Problems with OWQPs

- They were never set for most systems
- They are not a precise surrogate for lead release
 - Many interacting chemical & physical variables
 - Large fraction of systems aren't protected by simple Pb mineral scales
 - No theoretical basis for defining or setting parameters when scales are amorphous material of indefinite composition
- States set meaningless ranges to avoid spending time dealing with violations that don't relate to Pb release
 - DC: phosphate range: 0.5-5 mg/L, pH over 7.2 in system
 - Houston: pH 7.6-8.6; alkalinity "over 20)

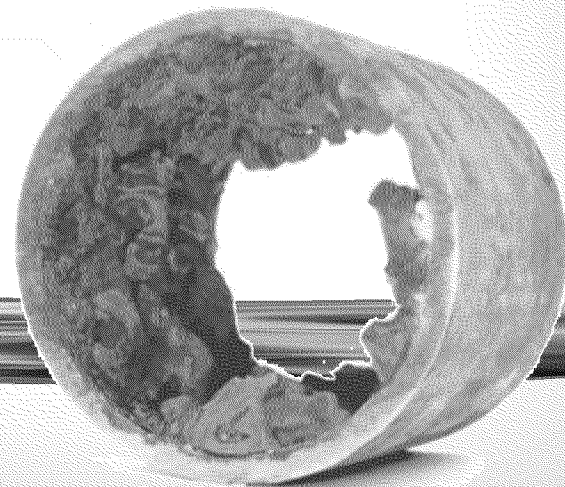


Simple Gaming to Hide LSL Release

- Full preflushing before stagnation period
 - NOT intended by LCR, which relies upon random starting point across a community to be sure that LSC contributions in corrosive waters are captured in 1st draw, 1st liter
 - Some systems have LSLs but plastic interior pipes, particularly misleading when coupled with pre-flush
 - Recall that LCR sample typically represents first 10-20 ft behind tap
- Suggest samples be takes as close as possible to 6 hours stagnation
- Select high water use sites
- Avoid sampling from areas of DS where repair/rehabilitation is being done
- Select sampling sites from least corrosive water when DS is fed by multiple water qualities
- Do not check/verify proper age or type of site (LSL, Pb:Sn solder)



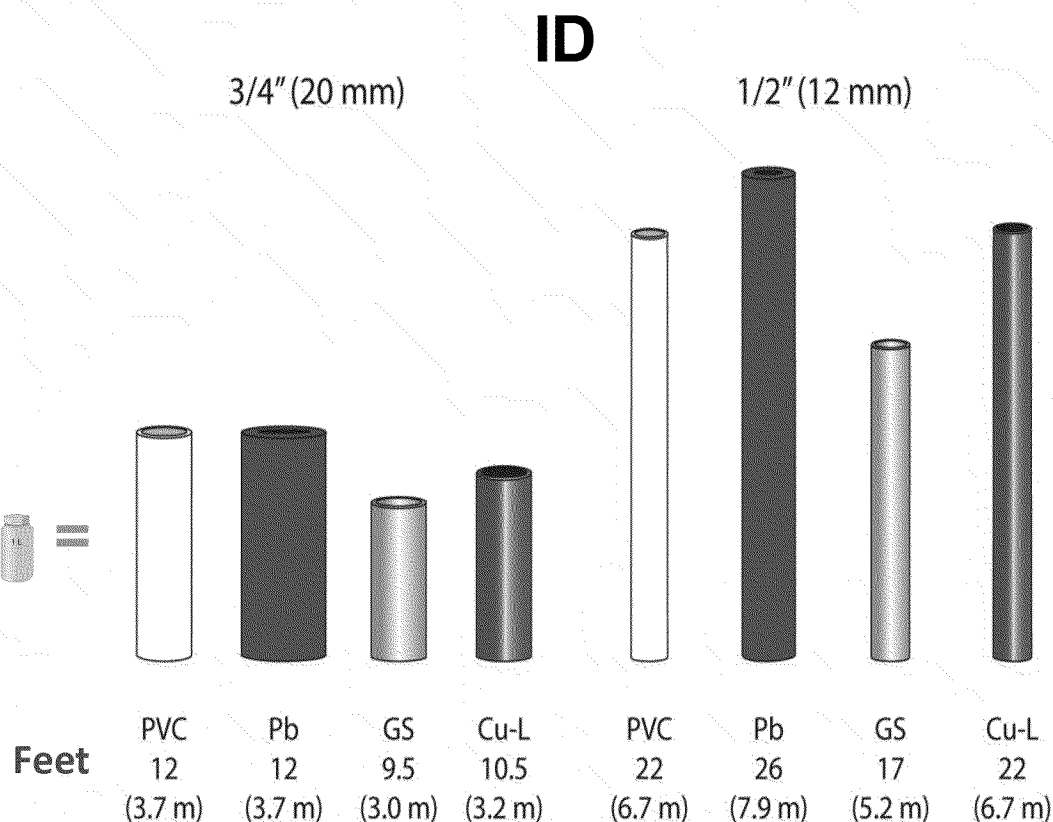
SAMPLING to Identify Lead Sources





Tool: Sample Volumes Represent Source Position in Plumbing

Wide-mouth bottles preferable to allow higher flow rate

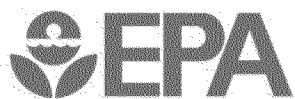


After: Schock, M. R.; Lytle, D. A. Internal Corrosion and Deposition Control; In *Water Quality and Treatment: A Handbook of Community Water Supplies*; Sixth ed. 2011.



Sample Volume Per Length: Cu

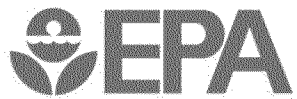
Material	Type	Nominal Size (in)	OD (in)	Thickness (in)	ID (in)	mL/ft	mL/m	ft per L	m per L
Copper tube	K	0.500	0.625	0.049	0.527	43	141	23.3	7.1
Copper tube	L	0.500	0.625	0.04	0.545	46	151	21.8	6.6
Copper tube	M	0.500	0.625	0.028	0.569	50	164	20.0	6.1
Copper tube	K	0.750	0.875	0.065	0.745	86	281	11.7	3.6
Copper tube	L	0.750	0.875	0.045	0.785	95	312	10.5	3.2
Copper tube	M	0.750	0.875	0.032	0.811	102	333	9.8	3.0
Copper tube	K	1.000	1.125	0.065	0.995	153	502	6.5	2.0
Copper tube	L	1.000	1.125	0.05	1.025	162	532	6.2	1.9
Copper tube	M	1.000	1.125	0.035	1.055	172	564	5.8	1.8



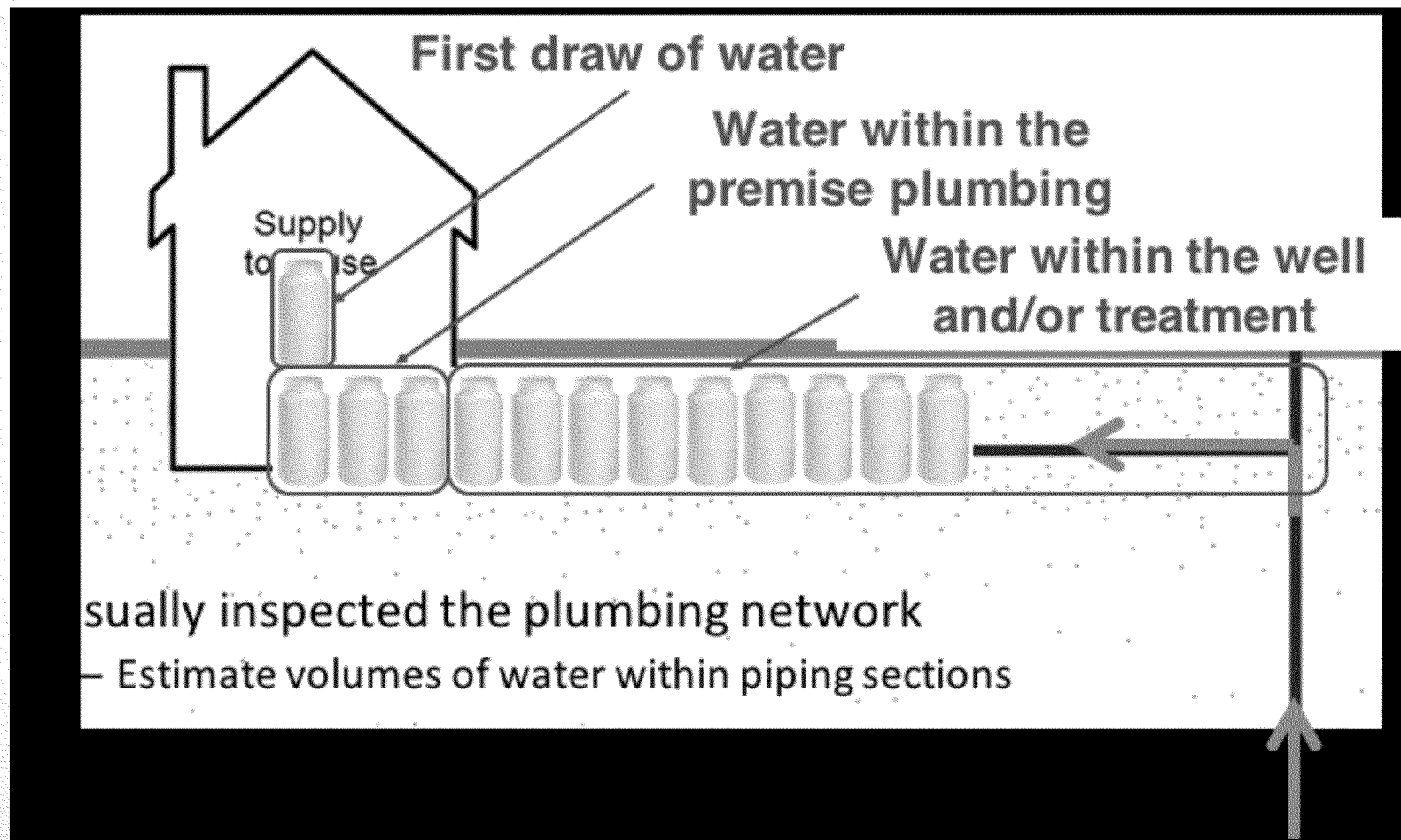
Sample Volume/Length (other)

Material	Type	Nominal Size (in)	OD (in)	Thickness (in)	ID (in)	mL/ft	mL/m	ft per L	m per L
Galvanized steel	Sched 40	0.500	0.840	0.109	0.622	60	196	16.7	5.1
Galvanized steel	Sched 40	0.750	1.050	0.113	0.824	105	344	9.5	2.9
Galvanized steel	Sched 40	1.000	1.315	0.133	1.049	170	558	5.9	1.8
Lead	0.25-in wall	0.500	1.000	0.25	0.500	39	127	25.9	7.9
Lead	0.25-in wall	0.625	1.125	0.25	0.625	60	198	16.6	5.1
Lead	0.25-in wall	0.750	1.250	0.25	0.750	87	285	11.5	3.5
PVC, CPVC	Sched 80	0.500	0.84	0.147	0.546	46	151	21.7	6.6
PVC, CPVC	Sched 80	0.75	1.05	0.154	0.742	85	279	11.8	3.6
PVC, CPVC	Sched 80	1	1.315	0.179	0.957	141	464	7.1	2.2
HDPE	200 psi	1	1.315	0.146	1.023	162	530	6.2	1.9





Concept of Sequential Sampling (aka “profiling”)

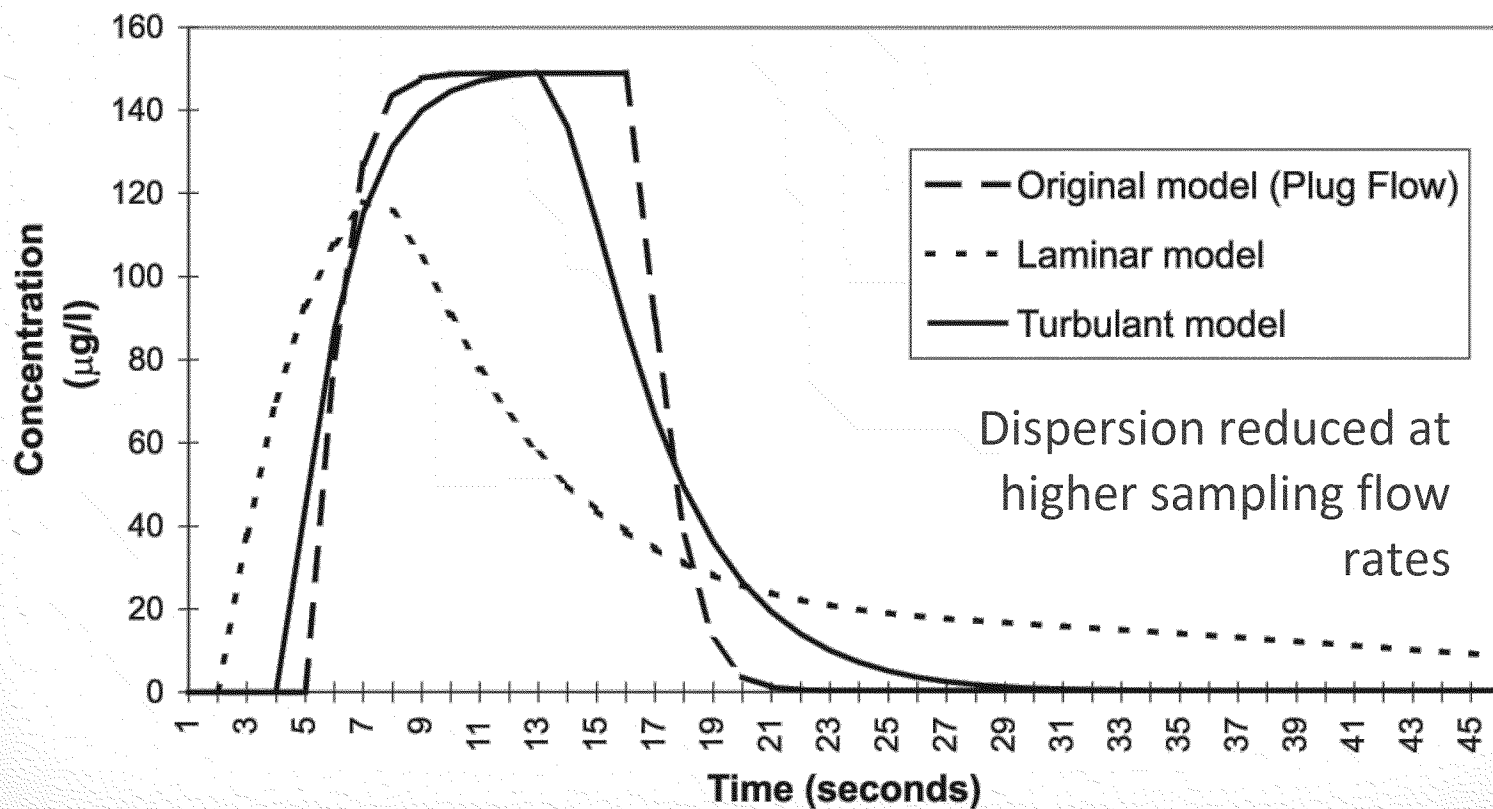


Courtesy: Kelsey Pieper, UNC

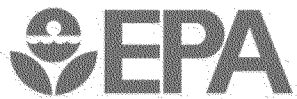


Resolution Depends on Dispersion

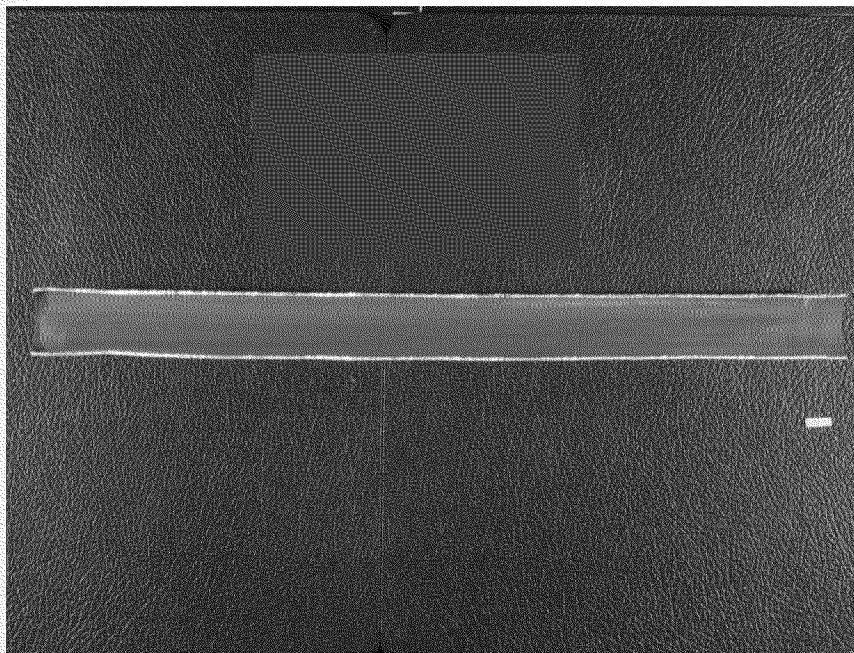
Average Concentration at Tap



From: VanDer Leer et. al. *Applied Mathematical Modelling*, (2002) 26:681–699



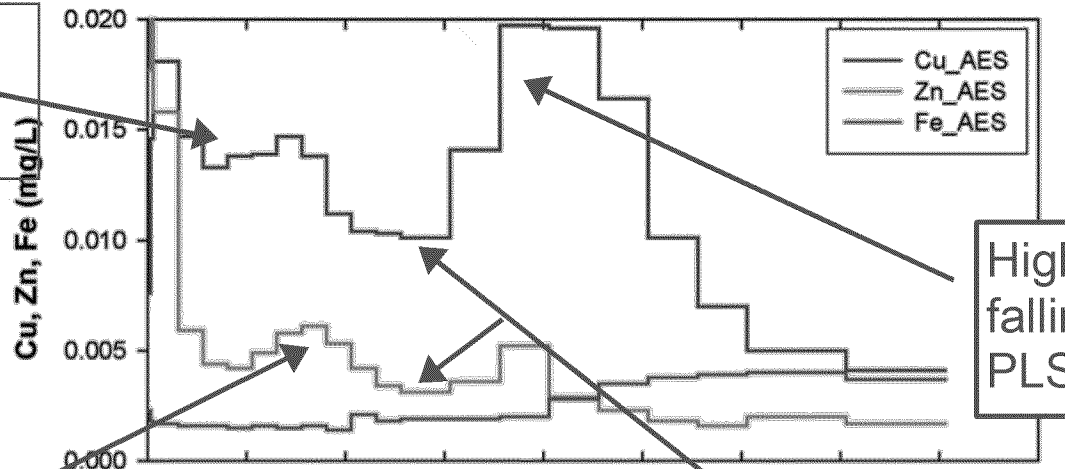
Tuberculation and Physi Characteristics Impact Fl





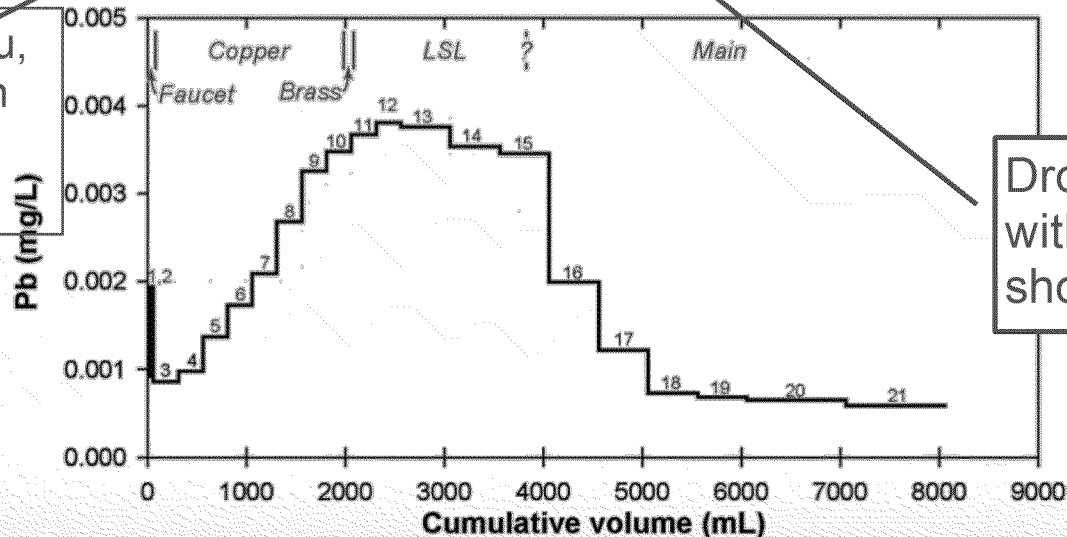
Including Cu, Zn and Fe is Very Useful

Consistent high Cu is interior piping



Higher copper with falling lead shows PLSLR

High Zn and Cu, associated with rising Pb is meter area

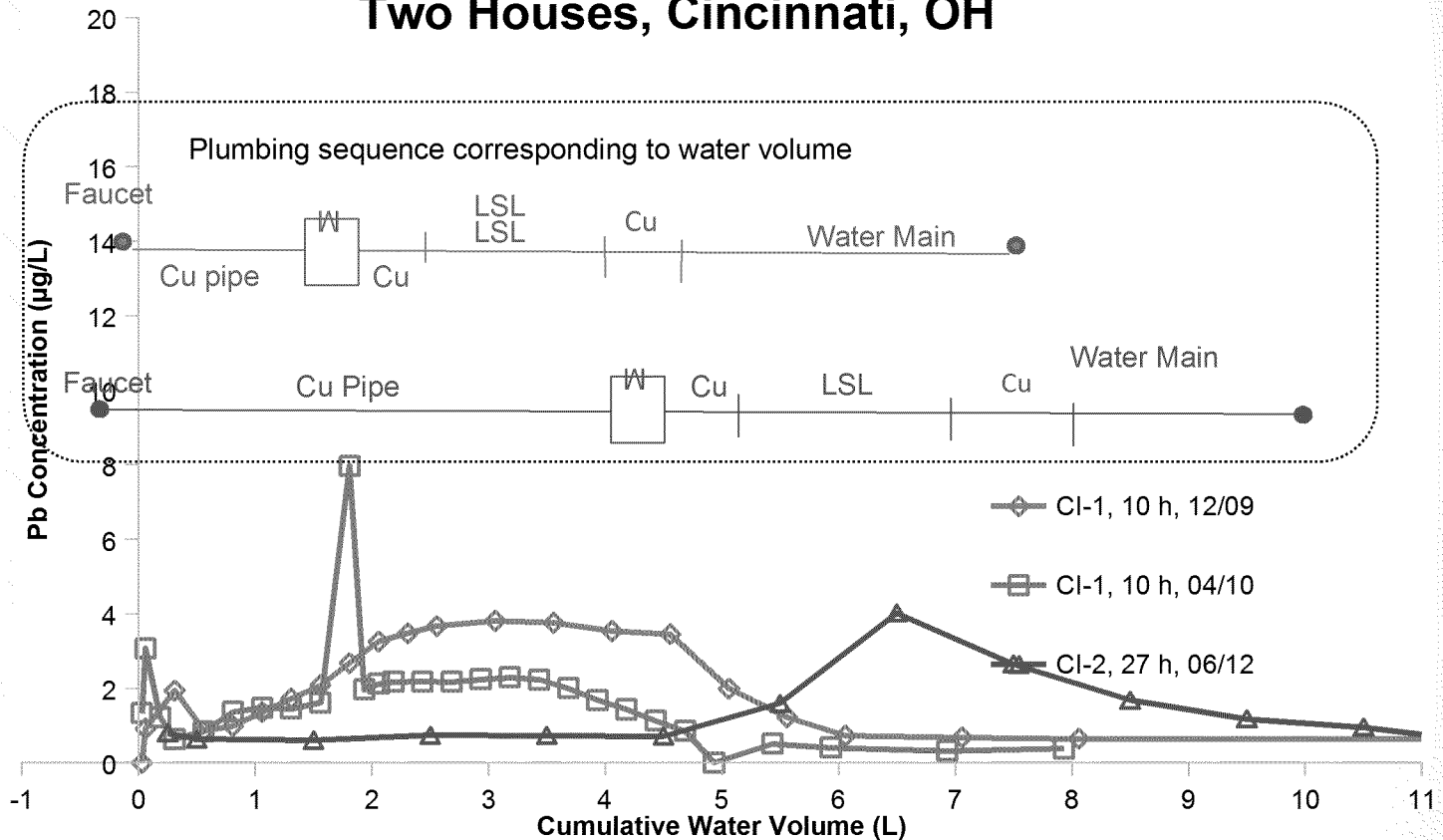


Dropping copper with dropping Zn shows LSL



Example Profiles of PbO₂ Scale House

Two Houses, Cincinnati, OH

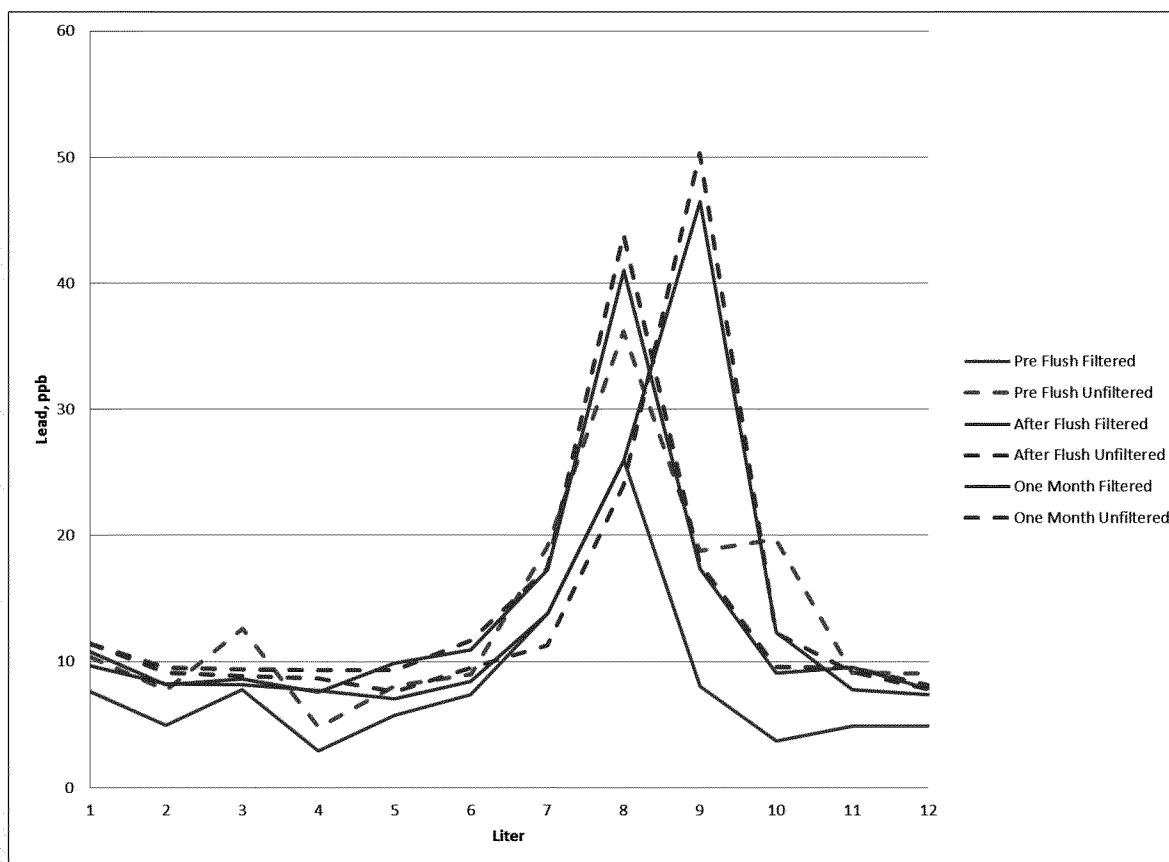


Peak lead at approximately 2.5 – 4 L, and approximately 6.5 L



Triplicate Profiles in a Different Area

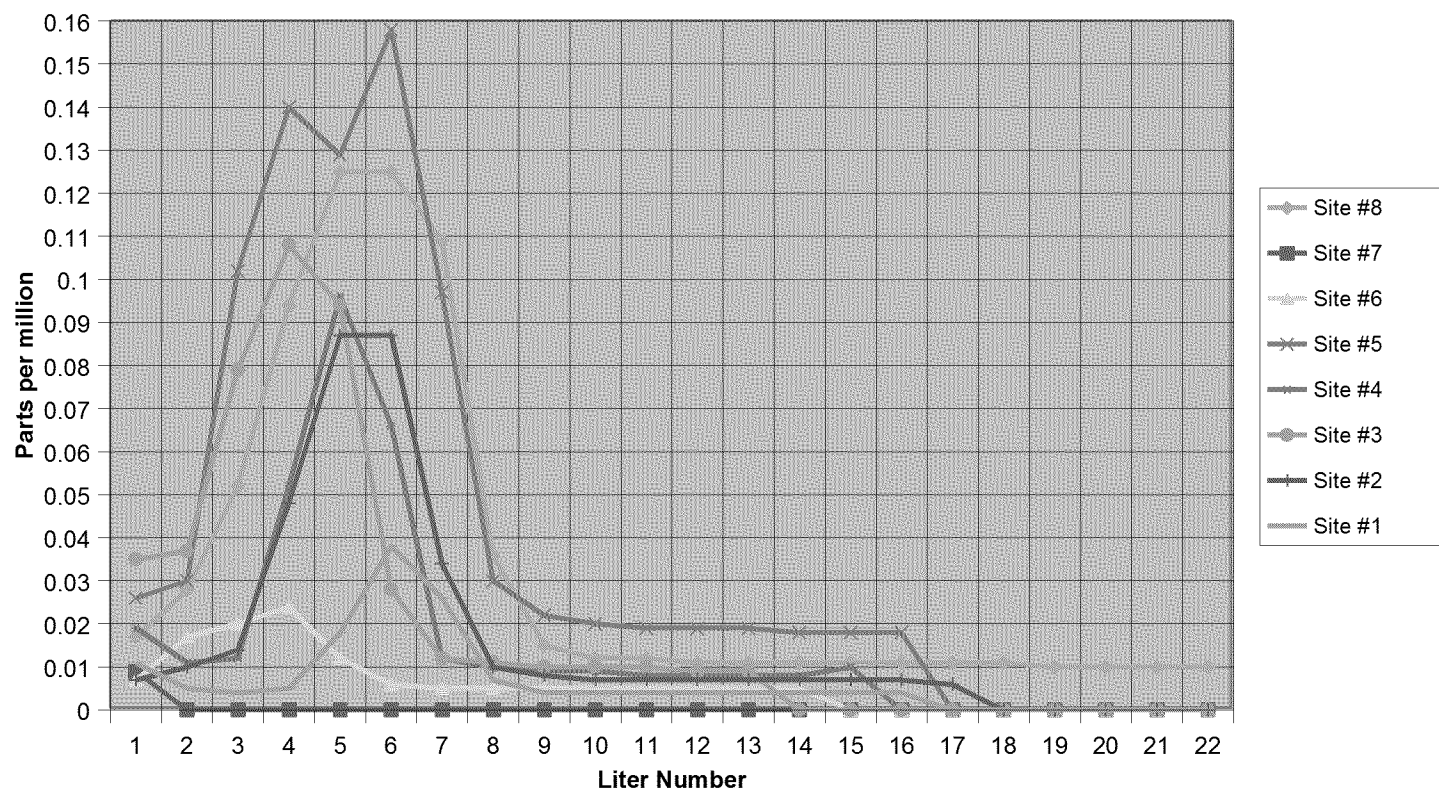
with no apparent difference in water age or water chemistry





LSL Profiles, Providence, RI

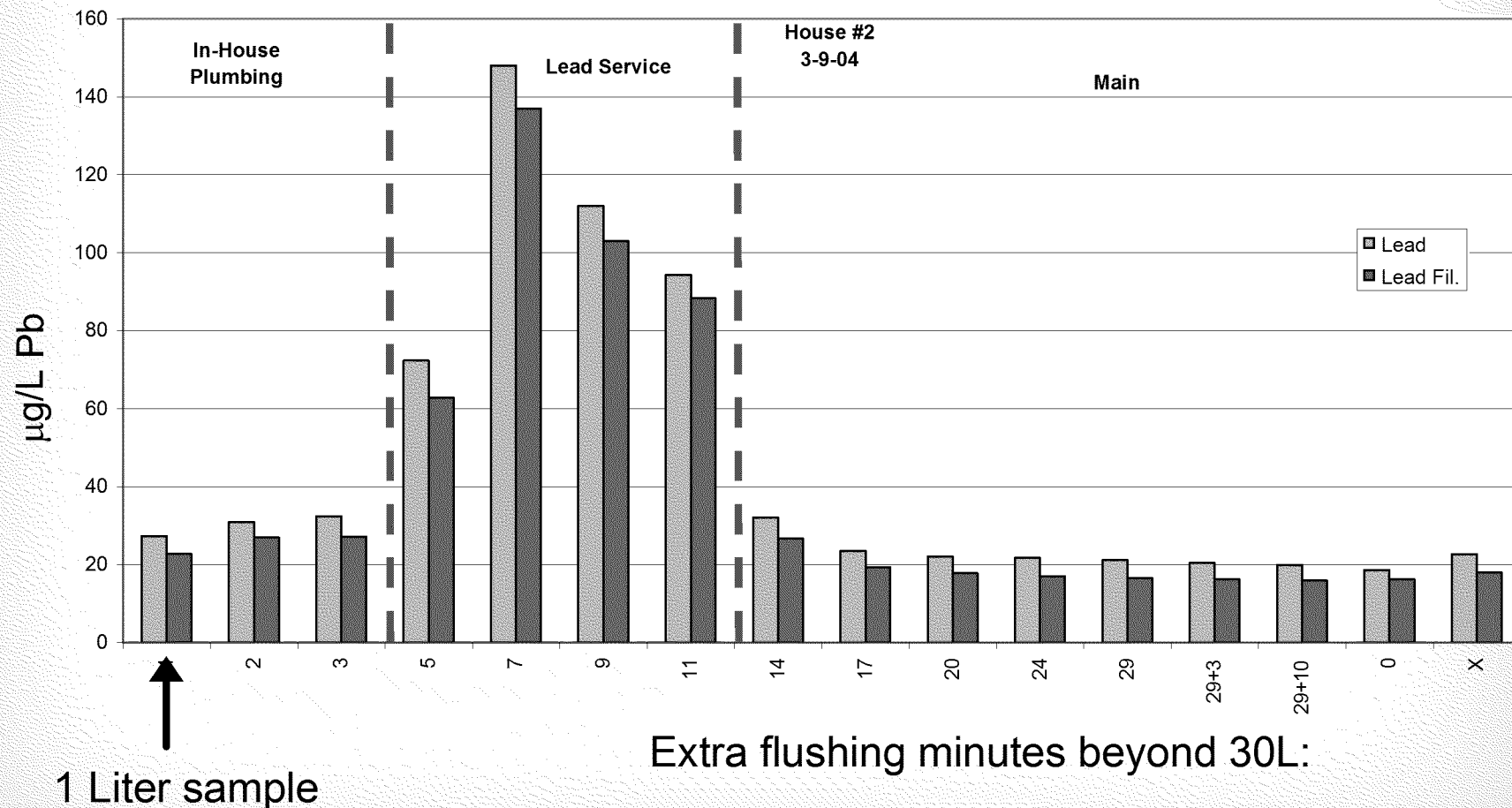
Lead in Drinking Water





First Draw May Not Reach Pb Contamination

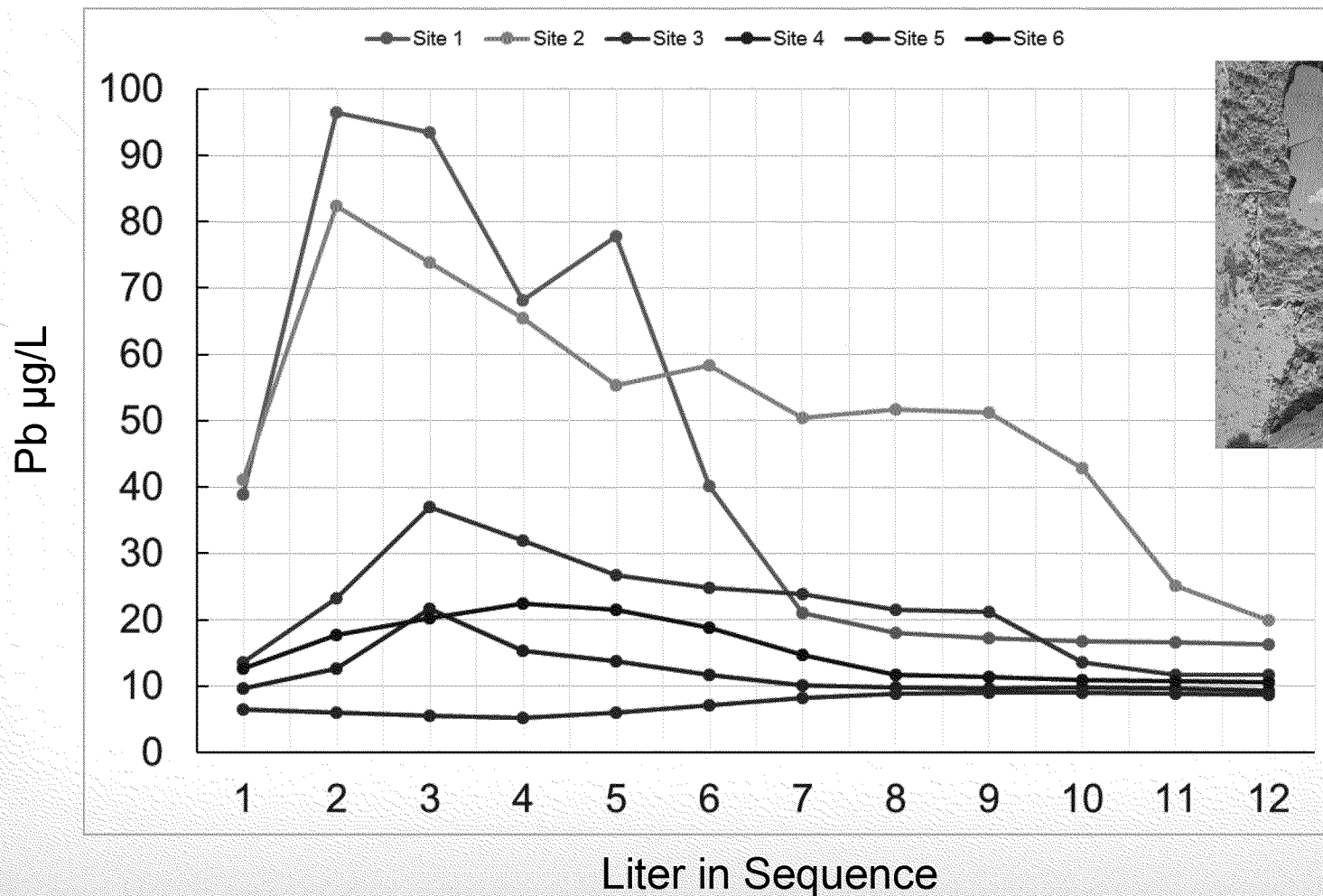
Need to "Profile" Sites for Public Education Flushing Guidance





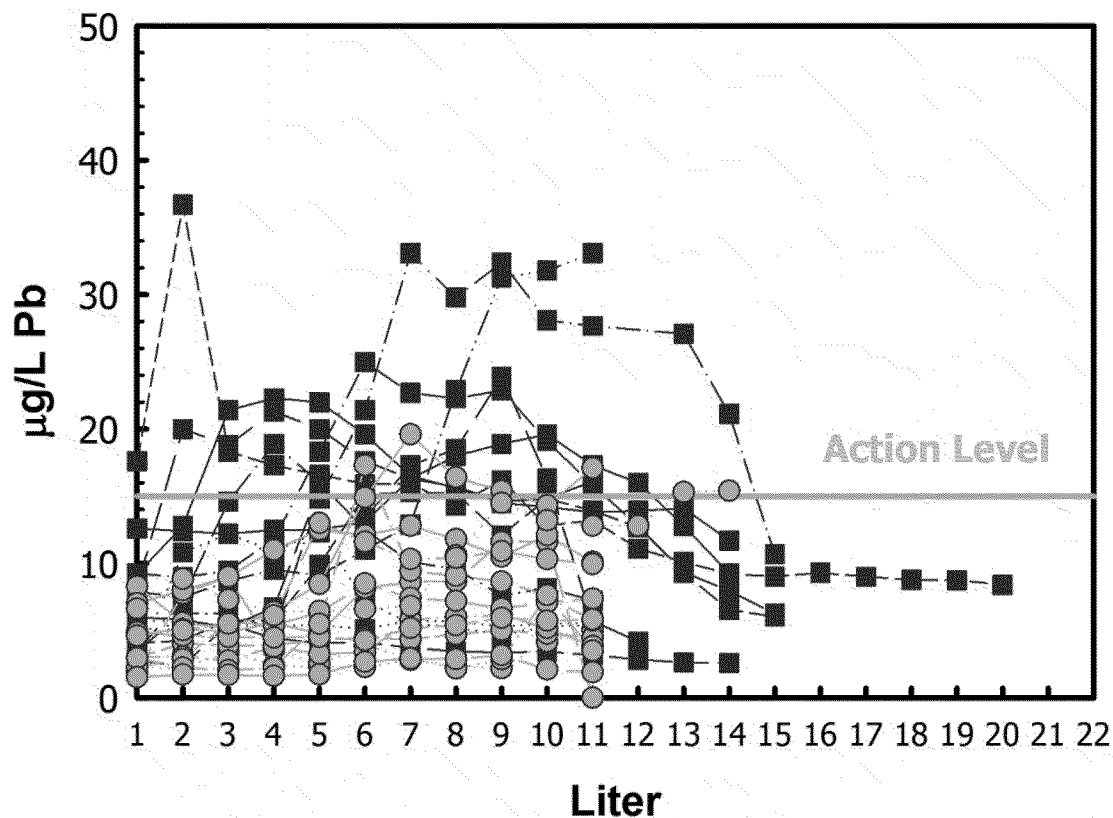
Pb Profile of Sites with Al-Si-Ca-Rich Deposit

< 10% Pb in surface scale, no crystalline Pb phases at surface





Impact of Disturbances in Past 7 Years Chicago (blended phosphate)

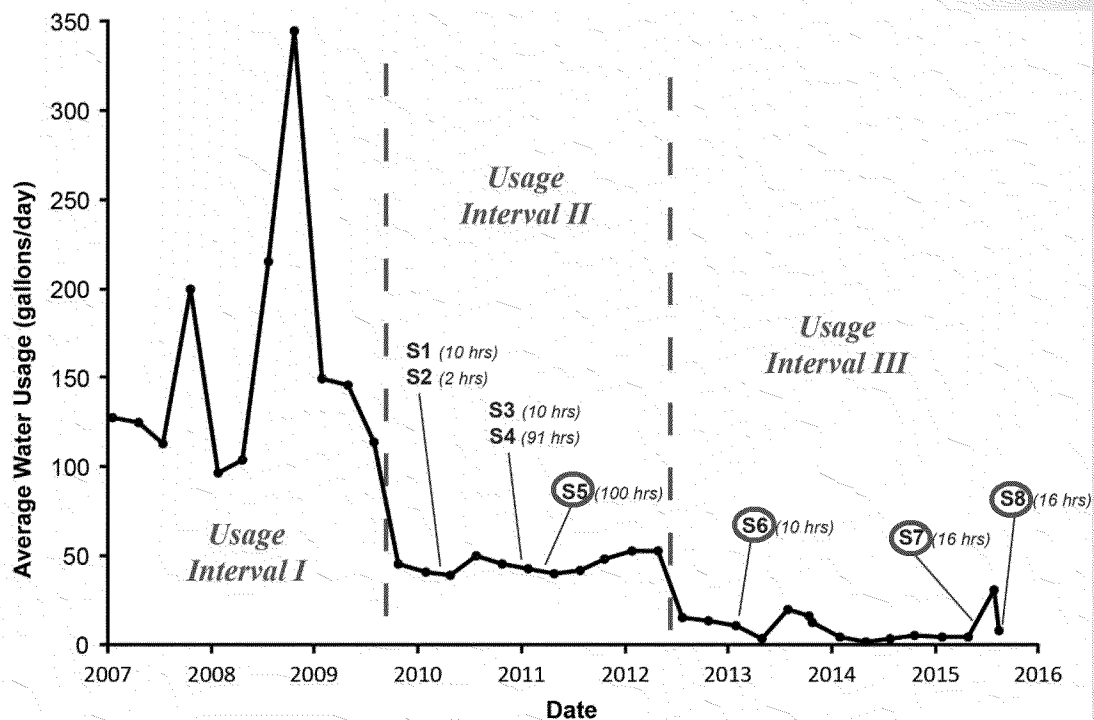
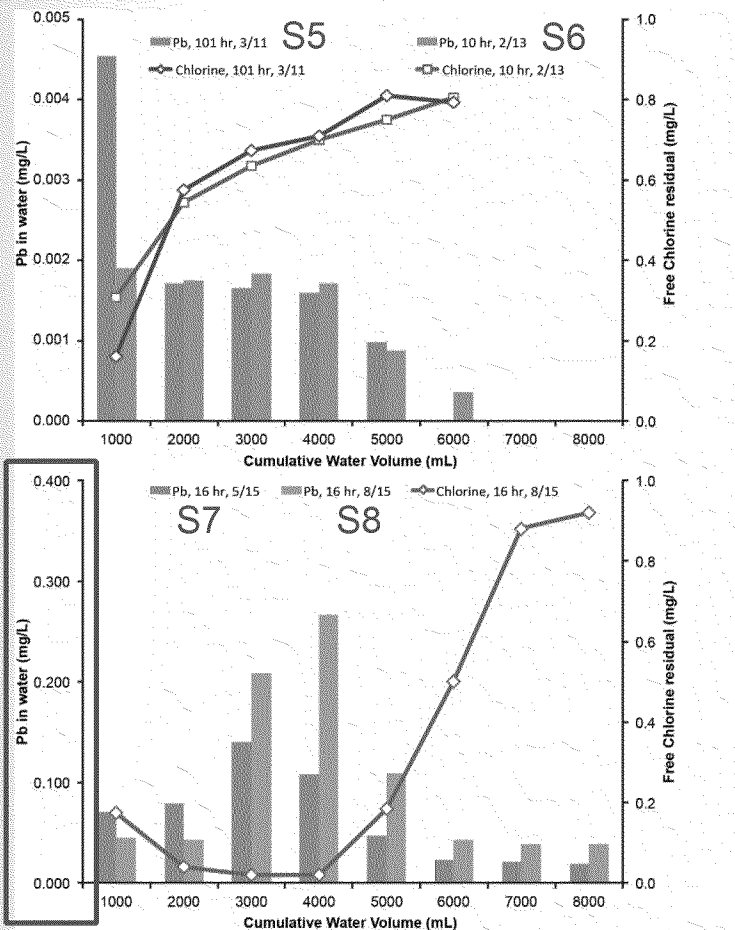


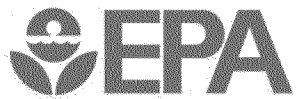
IMPORTANT POINTS

- Disturbed sites often double the Pb level
- Peak Pb liter varies with LSL length and plumbing configuration, consistent with other utilities that have done profiling
- Non-crystalline, amorphous scale
- Could not separate water use effect on lead levels



Beware of Vacant House & Low Use





Rule of Thumb from Profiling

- For systems with Pb(II) scales
- Peak Pb concentration in LSL \cong 4 to 8X 90th Percentile value



What Are the Risks of Leaving LSLs?

- Pb release can be high, erratic, or both, at any given site, *even with optimal corrosion control treatment*
- Infrastructure work (roads, main replacement, meters) will disturb pipe scales indefinitely
- Work on mains can leave air pockets that scour scale from inside LSLs and premise plumbing
- Utility may have to install extra treatment unit processes to remove interferences to passivation and lead release control
- Treatment changes, mistakes, accidents or natural disasters could mobilize massive quantities of dissolved and particulate Pb.



Approaches for Exposure Assessment

- Can be approached three ways
 - System-wide assessment of risk (population-based)
 - Targeted subgroup/pool of system, estimation of risk
 - Individual premise assessment of risk
- Demonstrated approaches by other countries or special studies
 - Random daytime sampling (RDT)
 - 30 minute stagnation, first liter (relies on leaded interior materials)
 - Proportional sampling apparatus



Approaches for Exposure Assessment (2)

- Promising future approaches amenable to bridging premise to community risk
 - Proportional samplers at taps of consumption in “representative” sites
 - POU-type filter units that aggregate and/or separate dissolved and particulate lead over known water use/time
 - Intensive RDT sampling at child exposure investigation sites, linked to water consumptive use (kind of manual “proportional sampling”)
 - Mathematical modeling of full profile, using simulated usage pattern (yet to be researched in US)



Questions/Discussion?

Michael R. Schock

U.S. Environmental Protection Agency

ORD, NRMRL, WSWRD, TTEB,

Cincinnati, Ohio 45268

schock.michael@epa.gov

**Water Division Hot Issues
Detroit, Michigan
November 30, 2015**

Issue: Flint Drinking Water - Lead

Background/Status: Since Flint returned to using water from the Great Lakes Water Authority, some corrosion control is being provided via orthophosphate provided by GLWA. Additional orthophosphate needs to be added by Flint as the pipe scale builds to prevent lead leaching. EPA's Task Force has provided technical comments on the needed dosing to MDEQ and Flint. Flint is expecting ordered chemical pumps to arrive soon and supplemental orthophosphate addition to begin by December 4. In addition, the Task Force will provide MDEQ and Flint with comments on the new Lead and Copper Rule sampling instructions, comments on MI Health and Human Services Drinking Water lead exposure sampling instructions, and Task Force recommendations on actions needed to evaluate the progress of corrosion control with GLWA water in the short-term and preparing for the transition to the Karegnondi Water Authority pipeline in the long-term.

Messages:

- Flint is getting some corrosion control with its return to GLWA water.
- Supplemental orthophosphate addition will start by December 4th.
- EPA Task Force continues to provide technical assistance to MDEQ and Flint on needed actions regarding corrosion control now and for the transition to KWA water in 2016.

Contact: Thomas Poy, R5 Water, 312-886-5991, poy.thomas@epa.gov

Nonresponsive

Nonresponsive

Nonresponsive

Nonresponsive

To: Lytle, Darren[Lytle.Darren@epa.gov]
From: Steve Via
Sent: Mon 11/30/2015 5:47:47 PM
Subject: RE: Request - Presentation at ACE in Chicago, June 2016

Darren,

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Session Title: Regulatory Update for Water Suppliers					
Moderator: Alan Roberson					
Session Description: (250 characters or less)					
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	#3	Invited	Opportunities and Challenges in Redrafting the LCR - A Utility Perspective	30 w/Q/A	Steve Estes-Smargiassi, Massachusetts Water Resources Authority
			How Many Lead Service Line Are		Richard Brown and David

#4	46200 / 46192	There and What Are Implications of Different Monitoring Strategies?	30 w/Q/A	Cornwell, Environmental Engineering and Technology, Inc.
#5	46438	Piloting Statewide Training: A Comparison of Water Loss Training Programs Across Multiple States	30 w/Q/A	Steve Cavanaugh, Cavanaugh & Associates
#6	46393	Distribution System Chlorine Residual Requirements Revisited	30 w/Q/A	Jeff Rosen, Corona Environmental Consulting

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Best regards,

Steve

Steve Via

Office 202.628-8303 | Direct 202.326.6130

svia@awwa.org | www.awwa.org

From: Lytle, Darren [mailto:Lytle.Darren@epa.gov]
Sent: Monday, November 30, 2015 10:29 AM
To: Steve Via <SVia@awwa.org>
Subject: RE: Request - Presentation at ACE in Chicago, June 2016

Steve,

Did you get a final word on this?

Thanks, Darren

Darren A. Lytle, Ph.D., P.E.

Branch Chief (Acting)

U.S. Environmental Protection Agency

26 West Martin Luther King Dr.

Cincinnati, Ohio 45268

Phone: (513) 569-7432

Fax: (513) 487-2543

email: lytle.darren@epa.gov

From: Lytle, Darren

Sent: Wednesday, November 11, 2015 6:49 PM

To: 'Steve Via' <SVia@awwa.org>

Subject: RE: Request - Presentation at ACE in Chicago, June 2016

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Fax: (513) 487-2543

email: lytle.darren@epa.gov

From: Steve Via [<mailto:SVia@awwa.org>]

Sent: Tuesday, November 10, 2015 9:35 AM

To: Lytle, Darren <Lytle.Darren@epa.gov>

Subject: Request - Presentation at ACE in Chicago, June 2016

Darren,

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Thanks in advance for your consideration.

Best regards,

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Steve Via

Regulatory Affairs Manager

American Water Works Association

1300 Eye Street NW, Suite 701W

Washington, DC 20005-3314

Office 202.628-8303 | **Direct** 202.326.6130

svia@awwa.org | www.awwa.org

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To: Steve Via[SVia@awwa.org]
From: Lytle, Darren
Sent: Mon 11/30/2015 6:06:51 PM
Subject: RE: Request - Presentation at ACE in Chicago, June 2016

Perfect. We will plan on it but understand things are very preliminary and can change. Darren

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email: lytle.darren@epa.gov

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Personal Email / Ex. 6 www.awwa.org

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To: Lytle, Darren[Lytle.Darren@epa.gov]
From: Schock, Michael
Sent: Mon 11/30/2015 6:09:18 PM
Subject: RE: Request - Presentation at ACE in Chicago, June 2016

Thanks. Would the DEQ folks come in wearing ostrich suits?

From: Lytle, Darren
Sent: Monday, November 30, 2015 1:07 PM
To: Schock, Michael <Schock.Michael@epa.gov>
Subject: FW: Request - Presentation at ACE in Chicago, June 2016

FYI

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Branch Chief (Acting)

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w/Q/A Consulting

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Steve

Steve Via

Office 202.628-8303 | Direct 202.326.6130

svia@awwa.org | www.awwa.org

From: Lytle, Darren [<mailto:Lytle.Darren@epa.gov>]

Sent: Monday, November 30, 2015 10:29 AM

To: Steve Via <SVia@awwa.org>

Subject: RE: Request - Presentation at ACE in Chicago, June 2016

Steve,

Did you get a final word on this?

Thanks, Darren

Darren A. Lytle, Ph.D., P.E.

Branch Chief (Acting)

U.S. Environmental Protection Agency

26 West Martin Luther King Dr.

Cincinnati, Ohio 45268

Phone: (513) 569-7432

Fax: (513) 487-2543

email: lytle.darren@epa.gov

From: Lytle, Darren

Sent: Wednesday, November 11, 2015 6:49 PM

To: 'Steve Via' <SVia@awwa.org>

Subject: RE: Request - Presentation at ACE in Chicago, June 2016

Steve,

Absolutely. Just returned from Flint yesterday. Are you looking for the standard 20-30 minute talk or could it be longer? I would suggest that the enhanced monitoring effort, corrosion control studies, etc.. that they are gearing up to start be included in the talk. Maybe Mike Schock (Mike is also on Flint's committee) can join me and we could do back to back talks covering all aspects and leave some time for discussion/questions. A lot can be learned from what they have experienced and where they are going. Let me know what you think. Darren

Darren A. Lytle, Ph.D., P.E.

Branch Chief (Acting)

U.S. Environmental Protection Agency

26 West Martin Luther King Dr.

Cincinnati, Ohio 45268

Phone: (513) 569-7432

Fax: (513) 487-2543

email: lytle.darren@epa.gov

From: Steve Via [<mailto:SVia@awwa.org>]

Sent: Tuesday, November 10, 2015 9:35 AM

To: Lytle, Darren <Lytle.Darren@epa.gov>

Subject: Request - Presentation at ACE in Chicago, June 2016

Darren,

There is a substantial amount of discussion about Flint MI's experience and the associated challenges it has had with coliform, DPBs and lead. It would be very helpful to the water sector if we had an third-party presentation of the simple chronology of events and factors that need to be weighed in managing water quality in Flint. As you are on the expert panel for Flint (and thus familiar with the information that is publically available) and are recognized in the field as an expert in water quality (you do have more than a few publications in the relevant topics), I was hoping you would be willing and able to make a presentation at ACE this June in Chicago. I was thinking of a title like – "Flint Michigan Water Quality Challenges – A Chronology and Contributing Factors" and hoping that you would keep the presentation very factual and based on publically available information so that we can help folks understand the situation and take away their own lessons learned.

Sorry to put this just on you, but the notion of a panel presentation seems unlikely to be productive given the long-term nature of the fix that is underway. This past week's memorandum from Peter Grevatt raises the profile of managing situations like Flint among state primacy agencies – it would be helpful if the entire community had a common technical understanding of the situation, beyond the talking points we read in the newspapers. Also, by ACE, perhaps some of the dust will have settled and a cohesive review of the data will be relatively straight forward for you to put together.

Thanks in advance for your consideration.

Best regards,

Steve

Steve Via

Regulatory Affairs Manager

American Water Works Association

1300 Eye Street NW, Suite 701W

Washington, DC 20005-3314

Office 202.628-8303 | **Direct** 202.326.6130

svia@awwa.org | www.awwa.org

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To: Lytle, Darren[Lytle.Darren@epa.gov]; Kaplan, Robert[kaplan.robert@epa.gov]
Cc: Schock, Michael[Schock.Michael@epa.gov]; Kempic, Jeffrey[Kempic.Jeffrey@epa.gov]; Poy, Thomas[poy.thomas@epa.gov]; Henry, Timothy[henry.timothy@epa.gov]; Bosscher, Valerie[bosscher.valerie@epa.gov]; Porter, Andrea[porters.andrea@epa.gov]
From: Deltoral, Miguel
Sent: Tue 12/1/2015 12:32:30 PM
Subject: RE: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

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<http://flintwaterstudy.org/information-for-flint-residents/chlorine-monitoring-in-flint-resident-ms-leeanne-walters-home>

Miguel A. Del Toral
Regulations Manager
U.S. EPA R5 GWDWB
77 West Jackson Blvd, (WG-15J)
Chicago, IL 60604
Phone: (312) 886-5253

From: Lytle, Darren
Sent: Tuesday, December 1, 2015 05:53 AM
To: Kaplan, Robert
Cc: Schock, Michael; Kempic, Jeffrey; Schock, Michael; Poy, Thomas; Deltoral, Miguel; Henry, Timothy
Subject: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

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From: Cupal, Suzanne [mailto:scupal@gchd.us]
Sent: Monday, November 30, 2015 4:17 PM
To: Lytle, Darren <Lytle.Darren@epa.gov>
Cc: Valacak, Mark <MVALACAK@gchd.us>; Henry, James <jhenry@gchd.us>
Subject: Rough Draft Legionnaires Disease Media Release

Darren-

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Thank you for your assistance.

Suzanne

Suzanne Cupal, M.P.H.
Public Health Supervisor
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From: Lytle, Darren
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On the timing of the response to the document, they would like it by COB today.

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Chicago, IL 60604
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Sent: Tuesday, December 1, 2015 05:53 AM
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From: Kaplan, Robert
Sent: Tue 12/1/2015 1:04:12 PM
Subject: Re: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

Task Force,

I certainly agree that this is urgent. I am in travel, back later today. The Health Dept press release looks fine - pls do not wait on me; let's make sure this gets out ASAP.

For next steps, do we all agree with Miguel's recommendations? And should EPA post the County Advisory in our website?

Bob

Sent from my iPhone

> On Dec 1, 2015, at 7:59 AM, Lytle, Darren <Lytle.Darren@epa.gov> wrote:

>

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From: Deltoral, Miguel
Sent: Tue 12/1/2015 2:25:58 PM
Subject: RE: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

Darren - You may want to check with Marc Edwards for data as well. I know he did a couple of rounds of testing for opportunistic pathogens in Flint. The latest was around October 15.

Miguel A. Del Toral
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Cc: Valacak, Mark <MVALACAK@gchd.us>; Henry, James <jhenry@gchd.us>
Subject: Rough Draft Legionnaires Disease Media Release

Darren-

The attached is a really rough draft of the media release. We would appreciate feedback from the EPA task force.

Thank you for your assistance.

Suzanne

Suzanne Cupal, M.P.H.
Public Health Supervisor
Genessee County Health Department
630 S. Saginaw Street
Suite 4
Flint, MI 48502
(810) 768-7970
scupal@gchd.us<mailto:scupal@gchd.us>

To: Deltoral, Miguel[deltoral.miguel@epa.gov]; Lytle, Darren[Lytle.Darren@epa.gov]; Kaplan, Robert[kaplan.robert@epa.gov]
Cc: Schock, Michael[Schock.Michael@epa.gov]; Poy, Thomas[poy.thomas@epa.gov]; Henry, Timothy[henry.timothy@epa.gov]; Bosscher, Valerie[bosscher.valerie@epa.gov]; Porter, Andrea[porters.andrea@epa.gov]
From: Kempic, Jeffrey
Sent: Tue 12/1/2015 2:41:39 PM
Subject: RE: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

All,

I think we need to be careful not to jump to conclusions. The press release states that "These Legionnaires Disease cases are being observed throughout Genesee County. There is no specific geographic pattern identified among the cases." Genesee County Michigan has a 2014 estimated population of 412,895 according to the US Census Bureau State and County Quick Facts and Flint has a 2014 estimated population of 99,002. It would be a good idea to try to determine which of the exposed population live in Flint and may be exposed through showering. However, if we are making recommendations about sampling, it should also apply to the Genesee County water system as well, since it represents the bulk of the population.

Jeff

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Cc: Schock, Michael <Schock.Michael@epa.gov>; Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>; Poy, Thomas <poy.thomas@epa.gov>; Henry, Timothy <henry.timothy@epa.gov>; Bosscher, Valerie <bosscher.valerie@epa.gov>; Porter, Andrea <porters.andrea@epa.gov>
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Regulations Manager
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77 West Jackson Blvd, (WG-15J)
Chicago, IL 60604
Phone: (312) 886-5253

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Cc: Schock, Michael; Kempic, Jeffrey; Poy, Thomas; Henry, Timothy; Bosscher, Valerie; Porter, Andrea
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Phone: (513) 569-7432
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<http://flintwaterstudy.org/information-for-flint-residents/chlorine-monitoring-in-flint-resident-ms-leeanne-walters-home>

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Subject: RE: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

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Tom

Tom Poy
Chief, Ground Water and Drinking Water Branch
USEPA - Region 5
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From: Lytle, Darren
Sent: Tue 12/1/2015 5:37:20 PM
Subject: RE: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

Message got out. Got a call from Laurel Garrison (CDC HQ, Legionella team). I gave her an update on Flint. She received the draft. She was concerned about the stated CDC role. They have minimal involvement. They do not work with County Health Departments. They work through the States. If the State needs help with county, they can request CDC help. That request has not happened. She is going back to her folks with the information. More to come.....

Darren

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From: Burneson, Eric
Sent: Tue 12/1/2015 5:44:08 PM
Subject: RE: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

Yes Jeff: I think we need to see the draft releases. Please include everyone on this email when you get them.

-----Original Message-----

From: Kempic, Jeffrey
Sent: Tuesday, December 01, 2015 12:27 PM
To: Christ, Lisa <Christ.Lisa@epa.gov>; Burneson, Eric <Burneson.Eric@epa.gov>
Subject: FW: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

FYI - latest from Flint area. Let me know if you want to see the draft release that will be revised later today.

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-----Original Message-----

From: Deltoral, Miguel
Sent: Tuesday, December 01, 2015 9:26 AM
To: Lytle, Darren <Lytle.Darren@epa.gov>; Kaplan, Robert <kaplan.robert@epa.gov>
Cc: Schock, Michael <Schock.Michael@epa.gov>; Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>; Poy, Thomas <poy.thomas@epa.gov>; Henry, Timothy <henry.timothy@epa.gov>; Bosscher, Valerie <bosscher.valerie@epa.gov>; Porter, Andrea <porter.andrea@epa.gov>
Subject: RE: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

Darren - You may want to check with Marc Edwards for data as well. I know he did a couple of rounds of testing for opportunistic pathogens in Flint. The latest was around October 15.

Miguel A. Del Toral
Regulations Manager
U.S. EPA R5 GWDWB
77 West Jackson Blvd, (WG-15J)
Chicago, IL 60604
Phone: (312) 886-5253

From: Lytle, Darren
Sent: Tuesday, December 1, 2015 06:59 AM
To: Deltoral, Miguel; Kaplan, Robert
Cc: Schock, Michael; Kempic, Jeffrey; Poy, Thomas; Henry, Timothy; Bosscher, Valerie; Porter, Andrea
Subject: RE: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

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On the timing of the response to the document, they would like it by COB today.

Darren

Darren A. Lytle, Ph.D., P.E.
Branch Chief (Acting)
U.S. Environmental Protection Agency
26 West Martin Luther King Dr.
Cincinnati, Ohio 45268
Phone: (513) 569-7432
Fax: (513) 487-2543
email: lytle.darren@epa.gov

-----Original Message-----

From: Deltoral, Miguel
Sent: Tuesday, December 01, 2015 7:33 AM
To: Lytle, Darren <Lytle.Darren@epa.gov>; Kaplan, Robert <kaplan.robert@epa.gov>
Cc: Schock, Michael <Schock.Michael@epa.gov>; Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>; Poy, Thomas <poy.thomas@epa.gov>; Henry, Timothy <henry.timothy@epa.gov>; Bosscher, Valerie <bosscher.valerie@epa.gov>; Porter, Andrea <porter.andrea@epa.gov>
Subject: RE: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release
Importance: High

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<http://flintwaterstudy.org/information-for-flint-residents/chlorine-monitoring-in-flint-resident-ms-leeanne-walters-home>

Miguel A. Del Toral
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Chicago, IL 60604
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From: Lytle, Darren
Sent: Tuesday, December 1, 2015 05:53 AM
To: Kaplan, Robert
Cc: Schock, Michael; Kempic, Jeffrey; Schock, Michael; Poy, Thomas; Deltoral, Miguel; Henry, Timothy
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Bob (and task force),

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On a different topic, were there any plans/discussion of the task force meeting in Flint next week? Mike and I had planned a trip up there because Flint's technical advisory group was supposed to meet. That meeting has been cancelled but we felt the need to still travel up there to meet with various groups. The Genessee County group would like to meet on Tuesday afternoon next week to go over their study.

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U.S. Environmental Protection Agency
Cincinnati, Ohio 45268

Phone: (513) 569-7432
Fax: (513) 487-2543
email: lytle.darren@epa.gov

From: Cupal, Suzanne [mailto:scupal@gchd.us]
Sent: Monday, November 30, 2015 4:17 PM
To: Lytle, Darren <Lytle.Darren@epa.gov>
Cc: Valacak, Mark <MVALACAK@gchd.us>; Henry, James <jhenry@gchd.us>
Subject: Rough Draft Legionnaires Disease Media Release

Darren-

The attached is a really rough draft of the media release. We would appreciate feedback from the EPA task force.

Thank you for your assistance.

Suzanne

Suzanne Cupal, M.P.H.
Public Health Supervisor
Genesee County Health Department
630 S. Saginaw Street
Suite 4
Flint, MI 48502
(810) 768-7970
scupal@gchd.us<mailto:scupal@gchd.us>

To: Loop, Travis[Loop.Travis@epa.gov]
From: Wadlington, Christina
Sent: Tue 12/1/2015 6:00:52 PM
Subject: FW: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release
Legionnaires Disease 11 15 DAL.doc

Christina Wadlington
U.S. Environmental Protection Agency
Office of Ground Water and Drinking Water
Tel: 202.566.1859
Email: wadlington.christina@epa.gov

-----Original Message-----

From: Kempic, Jeffrey
Sent: Tuesday, December 01, 2015 12:50 PM
To: Burneson, Eric <Burneson.Eric@epa.gov>; Christ, Lisa <Christ.Lisa@epa.gov>; Grevatt, Peter <Grevatt.Peter@epa.gov>; Clark, Becki <Clark.Beki@epa.gov>
Cc: Greene, Ashley <Greene.Ashley@epa.gov>; Wadlington, Christina <Wadlington.Christina@epa.gov>; Bergman, Ronald <Bergman.Ronald@epa.gov>; Lopez-Carbo, Maria <Lopez-Carbo.Maria@epa.gov>; Rodgers-Jenkins, Crystal <Rodgers-Jenkins.Crystal@epa.gov>; Cordero, Cesar <Cordero.Cesar@epa.gov>; Regli, Stig <Regli.Stig@epa.gov>
Subject: RE: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

This is the latest draft with Darren's edits as of 12:30 pm today.

Jeff

-----Original Message-----

From: Burneson, Eric
Sent: Tuesday, December 01, 2015 12:44 PM
To: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>; Christ, Lisa <Christ.Lisa@epa.gov>; Grevatt, Peter <Grevatt.Peter@epa.gov>; Clark, Becki <Clark.Beki@epa.gov>
Cc: Greene, Ashley <Greene.Ashley@epa.gov>; Wadlington, Christina <Wadlington.Christina@epa.gov>; Bergman, Ronald <Bergman.Ronald@epa.gov>; Lopez-Carbo, Maria <Lopez-Carbo.Maria@epa.gov>; Rodgers-Jenkins, Crystal <Rodgers-Jenkins.Crystal@epa.gov>; Cordero, Cesar <Cordero.Cesar@epa.gov>; Regli, Stig <Regli.Stig@epa.gov>
Subject: RE: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

Yes Jeff: I think we need to see the draft releases. Please include everyone on this email when you get them.

-----Original Message-----

From: Kempic, Jeffrey
Sent: Tuesday, December 01, 2015 12:27 PM
To: Christ, Lisa <Christ.Lisa@epa.gov>; Burneson, Eric <Burneson.Eric@epa.gov>
Subject: FW: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

FYI - latest from Flint area. Let me know if you want to see the draft release that will be revised later today.

Jeff

-----Original Message-----

From: Kempic, Jeffrey

Sent: Tuesday, December 01, 2015 9:42 AM

To: Deltoral, Miguel <deltoral.miguel@epa.gov>; Lytle, Darren <Lytle.Darren@epa.gov>; Kaplan, Robert <kaplan.robert@epa.gov>

Cc: Schock, Michael <Schock.Michael@epa.gov>; Poy, Thomas <poy.thomas@epa.gov>; Henry, Timothy <henry.timothy@epa.gov>; Bosscher, Valerie <bosscher.valerie@epa.gov>; Porter, Andrea <porter.andrea@epa.gov>

Subject: RE: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

All,

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Jeff

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Cc: Schock, Michael <Schock.Michael@epa.gov>; Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>; Poy, Thomas <poy.thomas@epa.gov>; Henry, Timothy <henry.timothy@epa.gov>; Bosscher, Valerie <bosscher.valerie@epa.gov>; Porter, Andrea <porter.andrea@epa.gov>

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Miguel A. Del Toral
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Chicago, IL 60604
Phone: (312) 886-5253

From: Lytle, Darren

Sent: Tuesday, December 1, 2015 06:59 AM

To: Deltoral, Miguel; Kaplan, Robert

Cc: Schock, Michael; Kempic, Jeffrey; Poy, Thomas; Henry, Timothy; Bosscher, Valerie; Porter, Andrea

Subject: RE: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

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email: lytle.darren@epa.gov

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To: Lytle, Darren <Lytle.Darren@epa.gov>; Kaplan, Robert <kaplan.robert@epa.gov>
Cc: Schock, Michael <Schock.Michael@epa.gov>; Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>; Poy, Thomas <poy.thomas@epa.gov>; Henry, Timothy <henry.timothy@epa.gov>; Bosscher, Valerie <bosscher.valerie@epa.gov>; Porter, Andrea <porter.andrea@epa.gov>
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<http://flintwaterstudy.org/information-for-flint-residents/chlorine-monitoring-in-flint-resident-ms-leeanne-walters-home>

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From: Lytle, Darren
Sent: Tuesday, December 1, 2015 05:53 AM
To: Kaplan, Robert
Cc: Schock, Michael; Kempic, Jeffrey; Schock, Michael; Poy, Thomas; Deltoral, Miguel; Henry, Timothy
Subject: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

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U.S. Environmental Protection Agency
Cincinnati, Ohio 45268
Phone: (513) 569-7432
Fax: (513) 487-2543
email: lytle.darren@epa.gov

From: Cupal, Suzanne [mailto:scupal@gchd.us]
Sent: Monday, November 30, 2015 4:17 PM
To: Lytle, Darren <Lytle.Darren@epa.gov>
Cc: Valacak, Mark <MVALACAK@gchd.us>; Henry, James <jhenry@gchd.us>
Subject: Rough Draft Legionnaires Disease Media Release

Darren-

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Thank you for your assistance.

Suzanne

Suzanne Cupal, M.P.H.
Public Health Supervisor
Genesee County Health Department
630 S. Saginaw Street

Suite 4
Flint, MI 48502
(810) 768-7970
scupal@gchd.us<mailto:scupal@gchd.us>

To: Kaplan, Robert[kaplan.robert@epa.gov]
From: Natasha Henderson
Sent: Tue 12/1/2015 8:39:28 PM
Subject: Re: Welcome back -

Hello Bob,
Tried giving you a call a few minutes ago but your Assistant said you were unavailable.

Corrosion control is near completion. The chemical feed pumps and phosphate chemical are on hand. Lab testing will start this week in an attempt to determine any possible negative consequences to the increased dosing.

Hope you had a great Holiday!

Thanks,

Natasha L. Henderson, City Administrator
City of Flint, Michigan
1101 S. Saginaw St.
Flint, MI 48502
Email: nhenderson@cityofflint.com
Phone: (810) 237-2057
www.cityofflint.com

On Tue, Dec 1, 2015 at 3:07 PM, Kaplan, Robert <kaplan.robert@epa.gov> wrote:

Hello Natasha,

I hope you didn't have to work your entire vacation week!

When you get a chance today, I'd like to get an update on the progress of feeding orthophosphate. My understanding from Mike Glasgow was the pumps were due to arrive, be installed, and the feeding would begin by the end of November.

Thanks,

Bob

Robert Kaplan

Deputy Regional Administrator

U.S. EPA Region 5

Phone: (312) 886-1499

Cell: (312) 515-9827

Fax: (312) 692-2075

To: Crooks, Jennifer[crooks.jennifer@epa.gov]; Poy, Thomas[poy.thomas@epa.gov]; Porter, Andrea[porters.andrea@epa.gov]; Deltoral, Miguel[deltoral.miguel@epa.gov]; Shoven, Heather[shoven.heather@epa.gov]; Damato, Nicholas[damato.nicholas@epa.gov]
From: Kuefler, Janet
Sent: Tue 12/1/2015 9:06:01 PM
Subject: RE: MI Dept of Health and Human Services

I thought that 4th grade reading level was the standard for readability of public information documents.

Janet Kuefler

Ground Water and Drinking Water Branch

State Programs Team Leader

United States Environmental Protection Agency, Region 5

77 West Jackson Blvd. (WG-15J)

Chicago, Illinois 60604

(312) 886-0123

kuefler.janet@epa.gov

From: Crooks, Jennifer
Sent: Tuesday, December 01, 2015 3:01 PM
To: Poy, Thomas <poy.thomas@epa.gov>; Porter, Andrea <porters.andrea@epa.gov>; Deltoral, Miguel <deltoral.miguel@epa.gov>; Shoven, Heather <shoven.heather@epa.gov>; Kuefler, Janet <kuefler.janet@epa.gov>; Damato, Nicholas <damato.nicholas@epa.gov>
Subject: MI Dept of Health and Human Services

As you recall, Tom P and I talked with Richard Benzie and Liane at the end of August about the State doing a voluntary consumer education about lead in drinking water. And Liane said they would pursue this (documented in our meeting notes). I contacted the State—Mike Prysby—at the end of October or early November to ask what the status was of this consumer education piece. I discussed the need for consumer education of lead especially in the very low-income areas of Flint that saw their children's Blood Lead Levels triple, especially for people that don't read newspaper or watch the TV news or have a smartphone. He said that it had not been done, due to competing priorities; e.g. all the FOIAs, citizen and press inquiries. He said he would look into the status of this consumer education. After several weeks of contacting him, I learned that the Michigan Dept of Health and Human Services was the lead on developing consumer education on lead.

Today I talked with Linda Dykema, a toxicologist with HHS. She said that she and her group have been working on a number of education documents. Genesee County Health Dept is helping HHS understand the needs of the citizens of Flint, such as reducing the reading levels of the HHS documents/improving the readability, and discussing with HHS the questions the citizens of Flint want answered.

HHS developed and sent out packets of information to all the schools in Flint to be distributed to every school-age child, to take home to the parents. However, these were not as effective as hoped, due to the difficulty in readability of the information. This information is being re-worked to be written at a 6th-grade level.

They have issued FAQ's, information to parents, pregnant women, and other information on lead in drinking water.

All the documents they have developed for consumer education on lead are on the website:

http://www.michigan.gov/deq/0,4561,7-135-3313_3675_73946---,00.html

Linda did say that these consumer education pieces must be vetted through the DEQ and the Governor's office, so the process is slow.

I talked about the need for people in the low-income neighborhoods with the highest BLLs, to have information mailed to them or direct contact to get the information to EVERYONE. Linda said that Genesee County Health Dept is under resourced—funding and people. But they had a great idea, to get AmeriCorp volunteers to go into the low-income neighborhoods and go door-to-door to provide people information on how to protect themselves and their families from the lead in the drinking water. Linda thinks that this idea is moving forward, but the lack of resources may have slowed the effort. I asked about the Governor's office providing additional funding for this project, but Linda said that the Governor's office provided supplemental funding to DEQ and HHS, but she didn't think Genesee County received any supplemental funding. Linda has a call with Genesee County HD this week, so she will check on the status of this project and get back to me. She said she would see if there was something EPA could assist the CHD with.

Jennifer

To: Crooks, Jennifer[crooks.jennifer@epa.gov]
From: Kuefler, Janet
Sent: Tue 12/1/2015 9:16:12 PM
Subject: RE: MI Dept of Health and Human Services

Thanks for gathering all of this info!

Janet Kuefler

Ground Water and Drinking Water Branch

State Programs Team Leader

United States Environmental Protection Agency, Region 5

77 West Jackson Blvd. (WG-15J)

Chicago, Illinois 60604

(312) 886-0123

kuefler.janet@epa.gov

From: Crooks, Jennifer
Sent: Tuesday, December 01, 2015 3:08 PM
To: Kuefler, Janet <kuefler.janet@epa.gov>
Subject: RE: MI Dept of Health and Human Services

I'm just repeating what she said—maybe she said 4th-6th grade reading level.

From: Kuefler, Janet

Sent: Tuesday, December 01, 2015 3:06 PM

To: Crooks, Jennifer <crooks.jennifer@epa.gov>; Poy, Thomas <poy.thomas@epa.gov>; Porter, Andrea <porter.andrea@epa.gov>; Deltoral, Miguel <deltoral.miguel@epa.gov>; Shoven, Heather <shoven.heather@epa.gov>; Damato, Nicholas <damato.nicholas@epa.gov>

Subject: RE: MI Dept of Health and Human Services

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Jennifer

NBC News Interview Notes

Overview of Interview

To provide an overview of lead in drinking water, the lead and copper rule, and the process underway to revise the rule.

Background on Lead and Copper Rule Requirements

The following provides an overview of the LCR's technical and regulatory background.

- Under the Safe Drinking Water Act (SDWA) EPA sets maximum contaminant level goals (MCLGs) and enforceable standards for drinking water quality.¹
- The MCLG for lead is zero because there is no level of exposure to lead that is without risk. Infants and children who drink water containing lead could experience delays in their physical or mental development, showing deficits in attention span and learning abilities. Adults who drink water containing lead over many years could develop kidney problems or high blood pressure.
- The MCLG for copper is 1.3 mg/L. Individuals who drink water containing copper in excess of the MCLG may experience gastrointestinal distress from short-term exposure, or liver or kidney damage from long-term exposure. Individuals with Wilson's Disease are particularly sensitive to copper exposure.
- Because the primary contribution of lead and copper to drinking water is leaching from service lines and in-home plumbing materials, EPA adopted a treatment technique for the LCR rather than a maximum contaminant level (MCL) monitored at the treatment plant.
 - The LCR required all public water systems (PWSs) serving 50,000 or more persons to optimize corrosion control to prevent the leaching of lead and copper from premise plumbing and drinking water distribution system components.
- Water systems must collect first draw samples (samples taken after water sat unused in a building for at least 6 hours) from residences. These residences are selected based upon their plumbing materials. The first tier for selecting sampling locations consists of single-family residences with lead service lines or lead bearing plumbing materials.
- The LCR has action levels of 0.015 mg/L for lead and 1.3 mg/L for copper. The lead action level is based on the practical feasibility of reducing lead through controlling corrosion. The action level for copper is set at the MCLG.
- An action level is not the same as an MCL. MCLs are an enforceable standard that cannot be exceeded without violation, whereas an action level is a trigger for additional treatment technique actions. A PWS violates the LCR when it does not take the triggered actions.
- When more than ten percent of tap water samples collected during any monitoring period exceed

¹ EPA establishes national primary drinking water regulations (NPDWRs) under SDWA. NPDWRs either establish a feasible maximum contaminant level or a treatment technique "to prevent known or anticipated adverse effects on the health of persons to the extent feasible."

the lead action level (i.e., if the 90th percentile exceeds the action level), a water systems is required to undertake the following actions, depending upon its size and corrosion control treatment status:

- Water systems serving fewer than 50,000 persons are considered optimized if their 90th percentile is below the action level. However, if monitoring results find their 90th percentile for lead or copper to be above the action level they must undertake:
 - Water quality parameter monitoring,
 - Corrosion control treatment optimization and
 - Source water monitoring.
- Water systems serving 50,000 or more persons or small systems that have already optimized corrosion control treatment and exceed the lead action level must undertake:
 - Public education and
 - Lead service line replacement.
- The rule requires systems that have installed corrosion control treatment to continue to operate and maintain corrosion control treatment and meet the water quality parameters set by the state. A system is in violation if it fails to meet these water quality parameters.
- Systems that are undertaking a treatment or source water change must notify the state in advance of the change to evaluate the impact upon corrosion control treatment.
- EPA requested input from the National Drinking Water Advisory Council (NDWAC) in 2014 on recommendations to improve the effectiveness of the rule. A NDWAC working group was formed that will present recommendations to the full NDWAC on Nov. 17-18.
- In addition to considering the recommendations of the NDWAC, EPA will carefully consider the lessons from Flint in developing proposed long term revisions to the LCR. For example, the specific steps that were required following the change in source from Detroit water to the Flint River were not clearly addressed by the LCR. In response, on November 3, 2015, EPA issued a memorandum that clarifies how corrosion control treatment (CCT) should be maintained when a community switches to a new source of water.

Appendix A. Case Study: Flint, MI

Background:

- In April 2014, the City of Flint ceased purchasing treated drinking water from the Detroit Water and Sewerage Department and began drawing water from the Flint River.
- Motivating factors for Flint's decision included:
 - A projected savings of \$12 million dollars a year.
 - The contract to purchase finished water from Detroit was expiring, and the terms of the new contract included a 30 year commitment and a rate hike of approximately 15%.
- The Flint River is an interim water source because the City of Flint joined the Karegnondi Water Authority (KWA), which is currently constructing a water pipeline to Lake Huron. This will be Flint's new water supply, with completion scheduled for 2016.
- Since switching water sources, Flint has been out of compliance with several drinking water regulations.

Total Coliform Rule

- Four months after starting operation, Flint began detecting E. coli and also found very low disinfectant residuals in the distribution system.
- These resulted in:
 - Two boil water advisories.
 - Acute Coliform MCL violation in August 2014.
 - Monthly Coliform MCL violation in August 2014.
 - Monthly Coliform MCL violation in September 2014.

Stage 2 Disinfection Byproduct (DBP) Rule

- In the July-September 2014 monitoring period, elevated levels of DBPs in Flint's water triggered a Stage 2 Operational Evaluation Level (OEL) action/report.
- The OEL was followed by a Total Trihalomethane (TTHM) MCL violation in the October – December 2014 period and the violation extended through June 2015.
- Typically, a water system in violation of the TTHM or haloacetic acids (HAA5) MCL may need up to a year to return to compliance with the locational running annual average (LRAA).
 - The LRAA compliance is based on an average of quarterly results calculated every four quarters.
 - A water system's LRAA that exceeds the MCL for TTHM or HAA5 does not necessarily mean the next quarter's results will bring the water system back into compliance (i.e., the average of the most recent results averaged with the three previous quarters must be below the MCL).

- Flint installed a new \$1M Granular Activated Carbon (GAC) treatment system to address disinfection byproducts. With the GAC treatment system in place, Flint has been able to comply with Stage 2 DBPR requirements.
- Violations issued:
 - TTHM MCL violation in December 2014.
 - TTHM MCL violation in March 2015.
 - TTHM MCL violation in June 2015.

Lead and Copper Rule:

- Finished water purchased from Detroit had been treated for corrosion control utilizing orthophosphate. Flint did not continue corrosion control treatment after changing its water source, resulting in elevated drinking water lead levels². The Michigan Department of Environmental Quality (MDEQ) interpreted the LCR as not requiring Flint to maintain corrosion control after the change.
- Flint completed two rounds of 6 month sampling.
 - First round: July-December 2014 with a 6 ppb 90th percentile.
 - Second round: January- June 2015 with an 11 ppb 90th percentile.
 - During the second round of sampling, Flint was approved by MI to only collect 60 samples due to a difference in population served.
- Existing Flint data show they did not have an action level exceedance (15 ppb) but the water system could not be deemed to have optimized corrosion control treatment because it did not meet the 141.81(b)(3) requirement (difference between the 90% tap monitoring results and highest source water result is below the Practical Quantitation Level).
- Researchers at the Hurley Medical Center, a teaching hospital in Flint, published data suggesting the percentage of children with elevated blood lead levels in Flint has increased since switching water sources.
- Several issues with Flint's tap sampling results have been raised, including:
 - Underrepresentation of vulnerable populations and "high risk" sites (i.e., homes with lead service lines).
 - Potential misrepresentation of results.
 - Inappropriate invalidation of high sample results by MDEQ.
 - MI sampling protocol allowing for pre-flushing prior to the required stagnation times that precede sample collection.

Background on the Karegnondi Water Authority (KWA) Pipeline

² PWSs serving more than 100,000 persons are required to collect 100 samples during each routine monitoring period, while systems serving between 50,000 to 100,000 persons must collect 60 samples per period.

- The Karegnondi Water Authority (KWA), a municipal water supply system, was incorporated in 2010 and began its first fiscal year on October 1, 2010. KWA consists of:
 - Genesee County Drain Commissioner,
 - Lapeer County Drain Commissioner,
 - Lapeer City,
 - Sanilac County Drain Commissioner (*not purchasing water from Detroit*), and
 - the City of Flint.
- The purpose of the Authority is to provide raw water to the region of the State of Michigan commonly referred to as the I-69 corridor.
- The pipeline will supply untreated water to the municipalities of the region, industrial customers, agribusinesses, rural agriculture developments, residential commercial light and heavy manufacturers.
- The boundaries of the water supply encompass over 2,400 square miles and over a half a million people.
- Several public water systems will be connecting to this new pipeline upon completion of construction in 2016.

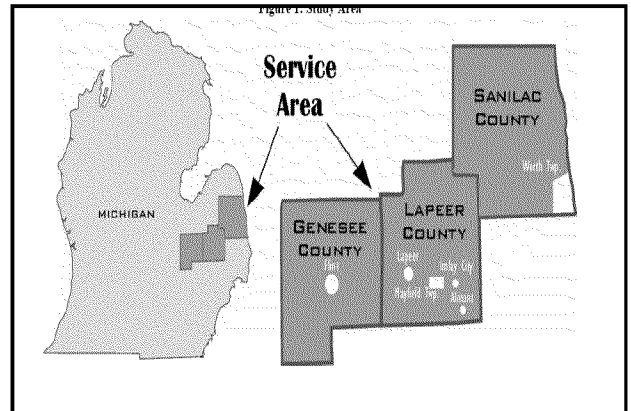
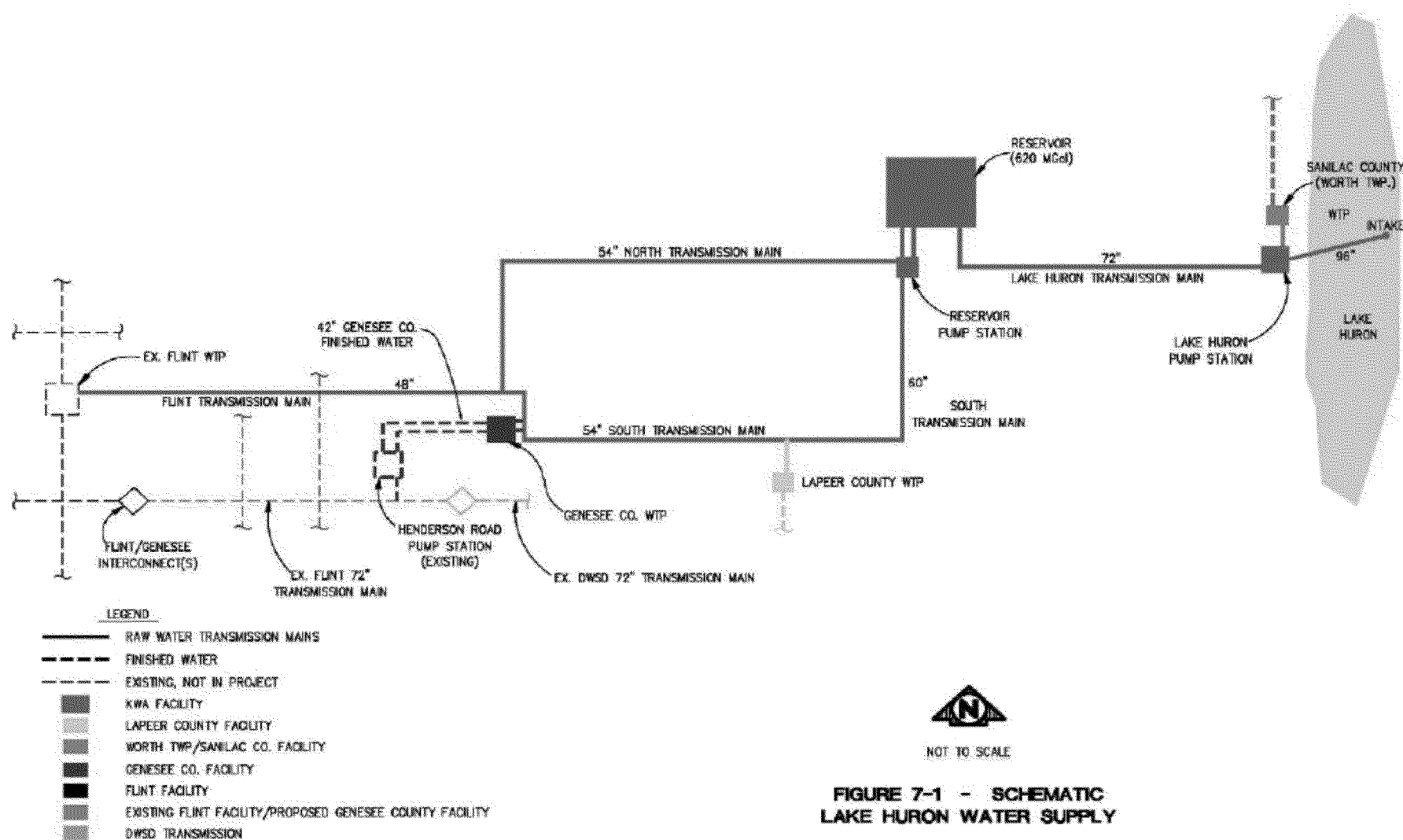


Table 3: Summary of Cost of New Lake Huron Water Supply

Project Component	Total Project Cost	Sanilac Co. Share	Lapeer Co. Share	GCDC-WWS Share	Flint Share
KWA Lake Huron Water Supply	\$443,885,767	\$813,723	\$86,312,736	\$188,899,927	\$167,859,381
New Sanilac Co. Facilities	\$1,849,360	\$1,849,360			
New Lapeer Co. Facilities	\$40,009,060		\$40,009,060		
New Genesee Co. Facilities / Upgrades	\$110,038,554			\$110,038,554	
New Flint Upgrades	\$5,987,030				\$5,987,030
Totals	\$601,769,771	\$2,663,083	\$126,321,796	\$298,938,481	\$173,846,411

Figure 7-1: Schematic



Appendix B. Summary of Remedial Actions Taken in Flint

The following appendix provides an overview of actions that have taken place since Flint's initial compliance challenges with the LCR. These actions have been led by city and state authorities, public interest groups and EPA.

- Ten Point Plan: Michigan and the City of Flint, with support from EPA, released a “ten point plan” to address drinking water issues. The plan was announced on October 2nd. The plan included:
 - Testing in Flint public schools.
 - Offering free water testing to Flint residents.
 - Providing free water filters to residents with concerns or who are included in state assistance programs.
 - Expanding health exposure testing of individuals homes.
 - Accelerating corrosion controls.
 - Accelerating water system improvements to address replacing lead service lines.
 - Expediting the completion of the KWA pipeline.
 - Expanding a Safe Drinking Water Technology Advisory Committee.
 - Naming Dr. Eden Wells, chief medical executive for the Michigan Department of Health and Human Services, as Flint drinking water public health advisor.
 - Boosting a comprehensive lead education program.
- Petition: On Friday October 2nd, the Natural Resources Defense Council (NRDC) submitted a petition to compel EPA to use SDWA 1431 authority³ on Flint. Region 5 is currently working with OECA and ORC to provide a response.
- Filters became available on Tuesday, October 6th. Approximately 5,500 filters were provided through private donations.
- Flint's Switch Back to Detroit Water: On October 16th Flint switched its source back to Detroit.
 - On October 15th, Michigan Gov. Rick Snyder (R) signed a supplemental appropriations bill that includes \$9.4 million to help the City of Flint reconnect its water supply to the Detroit water authority.
 - H.B. 4102, which passed the House October 14th and the Senate October 15th, provides \$6 million to facilitate the reconnection through June 30, 2016.
 - The C.S. Mott Foundation agreed to provide \$4 million to help the cash-strapped city with

³ EPA may issue an order pursuant to section 1431(a) when certain conditions exist which may present an imminent and substantial endangerment to the health of humans, and other state or local authorities have not acted, or do not have the authority to act, to protect human health.

the reconnection. The city itself is putting up \$2 million.

EPA's Activities in Flint, MI

- Region 5 and OGWDW are working together with OGC and OECA to provide guidance and clarification of rule requirements and emphasize the need to continue to treat for lead. In addition, EPA HQ will be updating training and optimal corrosion control treatment guidance manuals.
- In addition, EPA HQ is working closely with EPA Region 5 staff as they develop a transition plan to provide regulatory advice and guidance to MDEQ and the neighboring jurisdictions as they prepare to transition to the new KWA pipeline.
- The transition plan will include at a minimum:
 - Training the public water systems on all drinking water regulations to minimize a simultaneous compliance challenge, as the one faced by Flint.
 - Working closely with the primacy agency to identify and evaluate potential impacts resulting from the source and/or treatment change.
 - Working closely with the primacy agency to assess the technical, managerial and financial capacity of the public water system and provide training and technical assistance as needed to build that capacity.

Technical Task Force

- EPA established a Task Force to provide technical assistance to MDEQ and the City of Flint, as needed, in advance of and following connection to the Flint water system to a new source of drinking water that will be supplied by KWA, and to optimize corrosion control for the Flint system.
- Composition of the Task Force:
 - Region 5 Deputy Administrator Bob Kaplan, Chair;
 - Office of Research and Development Scientist Darren Lytle;
 - Office of Research and Development Scientist Michael Schock;
 - Office of Water Lead and Copper Rule Technical Lead Jeff Kempic;
 - Region 5 Water Division Deputy Director Tim Henry and
 - Region 5 Water Division Drinking Water Section Chief Tom Poy.
- EPA is currently identifying representatives from MDEQ and Flint Water Utility to join the Task Force.
- The first meeting of the Task Force is scheduled for November 10, 2015.
- EPA Task Force members have provided input on the School Sampling Plan that is currently being implemented. Three schools have been sampled by MDEQ.
- EPA Task Force members also provided input on the orthophosphate permit and accompanying

Corrosion Control Treatment Operation memorandum from MDEQ to the City of Flint Utilities Administrator, which was sent on Friday October 30, 2015. The memorandum outlines the supplemental orthophosphate treatment that Flint will need to add to the water being provided by Detroit and the necessary monitoring for assessing effectiveness.

Release of the LCR Requirements for Optimal Corrosion Control Treatment for Large Drinking Water Systems Memorandum

- The memorandum provides guidance on initial and ongoing LCR requirements for corrosion control, as well as notification requirements and best practices for any treatment- and/or source water-related system changes.
- The memorandum also stresses the importance of public water systems working with primacy agencies and outside technical consultants, as needed, to evaluate and address potential impacts of treatment and/or source water changes prior to, during and after implementation by the system.

EPA's MDEQ Audit

- On November 10, 2015, EPA announced that the agency's intentions to conduct an audit of the Michigan MDEQ drinking water program. This comprehensive audit will provide Flint residents and the people of Michigan with more information about MDEQ oversight of public water supplies and will identify actions that may be needed to strengthen the Michigan drinking water program.
- The on-site audit will take several months. As soon as it is complete, EPA will prepare an audit report and make the report available to the public

To: Lytle, Darren[Lytle.Darren@epa.gov]; Poy, Thomas[poy.thomas@epa.gov]
Cc: Schock, Michael[Schock.Michael@epa.gov]; Bosscher, Valerie[bosscher.valerie@epa.gov]; Porter, Andrea[porters.andrea@epa.gov]
From: Deltoral, Miguel
Sent: Wed 12/2/2015 1:56:45 PM
Subject: RE: Flint

Tom - I suggest we focus on lead instead of both lead and copper. Below is what I would recommend as far as lead sources. I did not include the time component because right now lead levels will likely increase rapidly and we are recommending that they continue to use filters/bottled water.

Darren/Mike?

Lead can be released into the water if:

1. You have a lead service line connecting your home to the water main, or
2. Your household copper piping and lead-soldered joints, or
3. Your household has plumbing components and fittings purchased before January 2014 that contain parts made of brass, such as faucets, valves, water meters or connectors.

The amount of lead released into the water depends on whether any of the above conditions exist, the aggressiveness of the water toward lead pipes and plumbing components which contain lead, and the effectiveness of the corrosion control treatment used to reduce lead levels.

Miguel A. Del Toral
Regulations Manager
U.S. EPA R5 GWDWB
77 West Jackson Blvd, (WG-15J)
Chicago, IL 60604
Phone: (312) 886-5253

From: Lytle, Darren
Sent: Tuesday, December 1, 2015 12:29 PM
To: Deltoral, Miguel; Poy, Thomas
Cc: Schock, Michael
Subject: RE: Flint

Agree. Something is mixed-up here. I do not recall providing this info. We should discuss this with them soon. Darren

Darren A. Lytle, Ph.D., P.E.
Branch Chief (Acting)
U.S. Environmental Protection Agency
26 West Martin Luther King Dr.
Cincinnati, Ohio 45268
Phone: (513) 569-7432
Fax: (513) 487-2543
email: lytle.darren@epa.gov

-----Original Message-----

From: Deltoral, Miguel
Sent: Tuesday, December 01, 2015 1:02 PM
To: Poy, Thomas <poy.thomas@epa.gov>
Cc: Schock, Michael <Schock.Michael@epa.gov>; Lytle, Darren <Lytle.Darren@epa.gov>

Subject: RE: Flint

This makes no sense. Maybe ORD gave them information on both lead and copper risks and it all got jumbled and thrown under the lead risk header. They should be separated out, so there is no confusion.

Miguel A. Del Toral
Regulations Manager
U.S. EPA R5 GWDWB
77 West Jackson Blvd, (WG-15J)
Chicago, IL 60604
Phone: (312) 886-5253

From: Poy, Thomas
Sent: Tuesday, December 1, 2015 10:00 AM
To: Deltoral, Miguel
Subject: Flint

Miguel: Take a look at this info below from Flint's website. It says that you're at risk if you have copper pipes and your home is less than 5 years old.
Tom

Sources of Lead in Drinking Water

Lead levels in your drinking water are likely to be highest if:

- * Your home has faucets or fittings of brass which contains some lead, or
- * Your home or water system has lead pipes, or
- * Your home has copper pipes with solder, and
- * The house is less than five years old, or
- * You have naturally soft water, or
- * Water often sits in the pipes for several hours.

Tom Poy
Chief, Ground Water and Drinking Water Branch USEPA - Region 5
(312) 886-5991

To: Speth, Thomas[Speth.Thomas@epa.gov]
From: Lytle, Darren
Sent: Wed 12/2/2015 2:17:09 PM
Subject: FW: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release
Legionnaires Disease 11 15 DAL.doc

Darren A. Lytle, Ph.D., P.E.
Branch Chief (Acting)
U.S. Environmental Protection Agency
26 West Martin Luther King Dr.
Cincinnati, Ohio 45268
Phone: (513) 569-7432
Fax: (513) 487-2543
email: lytle.darren@epa.gov

-----Original Message-----

From: Lytle, Darren
Sent: Tuesday, December 01, 2015 12:27 PM
To: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>; Deltoral, Miguel <deltoral.miguel@epa.gov>; Kaplan, Robert <kaplan.robert@epa.gov>
Cc: Schock, Michael <Schock.Michael@epa.gov>; Poy, Thomas <poy.thomas@epa.gov>; Henry, Timothy <henry.timothy@epa.gov>; Bosscher, Valerie <bosscher.valerie@epa.gov>; Porter, Andrea <porter.andrea@epa.gov>
Subject: RE: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

Deliberative Process / Ex. 5

Darren

Darren A. Lytle, Ph.D., P.E.
Branch Chief (Acting)
U.S. Environmental Protection Agency
26 West Martin Luther King Dr.
Cincinnati, Ohio 45268
Phone: (513) 569-7432
Fax: (513) 487-2543
email: lytle.darren@epa.gov

-----Original Message-----

From: Kempic, Jeffrey

Sent: Tuesday, December 01, 2015 9:42 AM

To: Deltoral, Miguel <deltoral.miguel@epa.gov>; Lytle, Darren <Lytle.Darren@epa.gov>; Kaplan, Robert <kaplan.robert@epa.gov>

Cc: Schock, Michael <Schock.Michael@epa.gov>; Poy, Thomas <poy.thomas@epa.gov>; Henry, Timothy <henry.timothy@epa.gov>; Bosscher, Valerie <bosscher.valerie@epa.gov>; Porter, Andrea <porter.andrea@epa.gov>

Subject: RE: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

Deliberative Process / Ex. 5

-----Original Message-----

From: Deltoral, Miguel

Sent: Tuesday, December 01, 2015 9:26 AM

To: Lytle, Darren <Lytle.Darren@epa.gov>; Kaplan, Robert <kaplan.robert@epa.gov>

Cc: Schock, Michael <Schock.Michael@epa.gov>; Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>; Poy, Thomas <poy.thomas@epa.gov>; Henry, Timothy <henry.timothy@epa.gov>; Bosscher, Valerie <bosscher.valerie@epa.gov>; Porter, Andrea <porter.andrea@epa.gov>

Subject: RE: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

Darren - You may want to check with Marc Edwards for data as well. I know he did a couple of rounds of testing for opportunistic pathogens in Flint. The latest was around October 15.

Miguel A. Del Toral

Regulations Manager

U.S. EPA R5 GWDWB

77 West Jackson Blvd, (WG-15J)

Chicago, IL 60604

Phone: (312) 886-5253

From: Lytle, Darren

Sent: Tuesday, December 1, 2015 06:59 AM

To: Deltoral, Miguel; Kaplan, Robert

Cc: Schock, Michael; Kempic, Jeffrey; Poy, Thomas; Henry, Timothy; Bosscher, Valerie; Porter, Andrea

Subject: RE: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

Deliberative Process / Ex. 5

Deliberative Process / Ex. 5

Darren

Darren A. Lytle, Ph.D., P.E.
Branch Chief (Acting)
U.S. Environmental Protection Agency
26 West Martin Luther King Dr.
Cincinnati, Ohio 45268
Phone: (513) 569-7432
Fax: (513) 487-2543
email: lytle.darren@epa.gov

-----Original Message-----

From: Deltoral, Miguel

Sent: Tuesday, December 01, 2015 7:33 AM

To: Lytle, Darren <Lytle.Darren@epa.gov>; Kaplan, Robert <kaplan.robert@epa.gov>

Cc: Schock, Michael <Schock.Michael@epa.gov>; Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>; Poy, Thomas <poy.thomas@epa.gov>; Henry, Timothy <henry.timothy@epa.gov>; Bosscher, Valerie <bosscher.valerie@epa.gov>; Porter, Andrea <porter.andrea@epa.gov>

Subject: RE: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

Importance: High

Deliberative Process / Ex. 5

<http://flintwaterstudy.org/information-for-flint-residents/chlorine-monitoring-in-flint-resident-ms-leeanne-walters-home>

Miguel A. Del Toral
Regulations Manager
U.S. EPA R5 GWDWB
77 West Jackson Blvd, (WG-15J)
Chicago, IL 60604
Phone: (312) 886-5253

From: Lytle, Darren
Sent: Tuesday, December 1, 2015 05:53 AM
To: Kaplan, Robert
Cc: Schock, Michael; Kempic, Jeffrey; Schock, Michael; Poy, Thomas; Deltoral, Miguel; Henry, Timothy
Subject: NEEDS IMMEDIATE ATTENTION FW: Rough Draft Legionnaires Disease Media Release

Bob (and task force),

Deliberative Process / Ex. 5

Darren

Darren A. Lytle, Ph.D., P.E.
Branch Chief (Acting)
U.S. Environmental Protection Agency
Cincinnati, Ohio 45268
Phone: (513) 569-7432
Fax: (513) 487-2543
email: lytle.darren@epa.gov

From: Cupal, Suzanne [mailto:scupal@gchd.us]
Sent: Monday, November 30, 2015 4:17 PM
To: Lytle, Darren <Lytle.Darren@epa.gov>
Cc: Valacak, Mark <MVALACAK@gchd.us>; Henry, James <jhenry@gchd.us>
Subject: Rough Draft Legionnaires Disease Media Release

Darren-

The attached is a really rough draft of the media release. We would appreciate feedback from the EPA task force.

Thank you for your assistance.

Suzanne

Suzanne Cupal, M.P.H.
Public Health Supervisor
Genesee County Health Department
630 S. Saginaw Street
Suite 4
Flint, MI 48502

(810) 768-7970
scupal@gchd.us<mailto:scupal@gchd.us>

To: Deltoral, Miguel[deltoral.miguel@epa.gov]; Poy, Thomas[poy.thomas@epa.gov]
Cc: Schock, Michael[Schock.Michael@epa.gov]; Bosscher, Valerie[bosscher.valerie@epa.gov]; Porter, Andrea[porters.andrea@epa.gov]
From: Lytle, Darren
Sent: Wed 12/2/2015 3:34:06 PM
Subject: RE: Flint

I am good with this, Darren

Darren A. Lytle, Ph.D., P.E.
Branch Chief (Acting)
U.S. Environmental Protection Agency
26 West Martin Luther King Dr.
Cincinnati, Ohio 45268
Phone: (513) 569-7432
Fax: (513) 487-2543
email: lytle.darren@epa.gov

-----Original Message-----

From: Deltoral, Miguel
Sent: Wednesday, December 02, 2015 8:57 AM
To: Lytle, Darren <Lytle.Darren@epa.gov>; Poy, Thomas <poy.thomas@epa.gov>
Cc: Schock, Michael <Schock.Michael@epa.gov>; Bosscher, Valerie <bosscher.valerie@epa.gov>; Porter, Andrea <porters.andrea@epa.gov>
Subject: RE: Flint

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To: Deltoral, Miguel; Poy, Thomas
Cc: Schock, Michael

Subject: RE: Flint

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email: lytle.darren@epa.gov

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From: Deltoral, Miguel
Sent: Tuesday, December 01, 2015 1:02 PM
To: Poy, Thomas <poy.thomas@epa.gov>
Cc: Schock, Michael <Schock.Michael@epa.gov>; Lytle, Darren <Lytle.Darren@epa.gov>
Subject: RE: Flint

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Miguel A. Del Toral
Regulations Manager
U.S. EPA R5 GWDWB
77 West Jackson Blvd, (WG-15J)
Chicago, IL 60604
Phone: (312) 886-5253

From: Poy, Thomas
Sent: Tuesday, December 1, 2015 10:00 AM
To: Deltoral, Miguel
Subject: Flint

Miguel: Take a look at this info below from Flint's website. It says that you're at risk if you have copper pipes and your home is less than 5 years old.
Tom

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- * Your home has faucets or fittings of brass which contains some lead, or
- * Your home or water system has lead pipes, or
- * Your home has copper pipes with solder, and
- * The house is less than five years old, or
- * You have naturally soft water, or
- * Water often sits in the pipes for several hours.

Tom Poy
Chief, Ground Water and Drinking Water Branch USEPA - Region 5
(312) 886-5991

FLINT DRINKING WATER CLIPS

US. EPA REGION 5 – AS PREPARED BY PETER CASSELL (ORA/OEC/PA) ON NOV. 18

Refund Flint \$2 million for cost of Detroit water, Kildee tells Gov. Snyder

EPA group to take testimony on Flint water crisis as it weighs rule changes

Read resignation letter of Flint official in charge of city water

Michiganders Say Flint Water Was Toxic

Flint officials, expert hit lead contamination law

REFUND FLINT \$2 MILLION FOR COST OF DETROIT WATER, KILDEE TELLS GOV. SNYDER (FLINT JOURNAL)

[HTTP://WWW.MLIVE.COM/NEWS/FLINT/INDEX.SSF/2015/11/KILDEE ASKS GOV SNYDER FOR PAY.HTML](http://www.mlive.com/news/flint/index.ssf/2015/11/kildee_asks_gov_snyder_for_pay.html)

By [Ron Fonger](#) | rfonger1@mlive.com

on November 18, 2015 at 5:00 AM, updated November 18, 2015 at 7:47 AM

FLINT, MI -- The state of Michigan should repair damage to Flint's water lines, create a fund for ongoing assistance here, and reimburse the city for the \$2 million it's spending to temporarily reconnect to the Detroit water system, U.S. Rep. Dan Kildee says.

The Flint Democrat outlined his requests in a Nov. 13 letter to Gov. Rick Snyder, saying "the state -- not Flint -- created this [water crisis](#), and the state needs to fix it."

"We look forward to continuing work with Congressman Kildee and other officials and stakeholders at the federal, state and local levels to bring ideas and resources to bear to ensure public health in Flint and clean, safe drinking water," said Snyder spokesperson Sara Wurfel. "And again, we have the multiple step action plan as well as the task force work underway."

Kildee's letter says his requests "need to be taken to remediate the damage done to the people of Flint due to the failures at the state government level."

Flint remains in a public health emergency due to increased lead levels in water earlier this year. Levels of the toxic metal spiked after the city changed its water source to the Flint River in April 2014 -- a time when the city was being run by a state-appointed emergency manager.

The state Department of Environmental Quality has also acknowledged it mistakenly allowed the city to distribute river water without requiring it to be treated to make it less corrosive --

something that could have reduced lead leaching.

Here are Kildee's three requests:

That the state use its Safe Drinking Water Revolving Funds and other state funds to repair damage done to Flint's water distribution system by river water. "Due to the corrosive nature of the water, conservative estimates show there has been hundreds of millions of dollars of damage done to Flint's water distribution system ... Furthermore, the presence of over 15,000 lead service lines continues to threaten the quality of water and creates the potential for future lead exposure through drinking water."

That the state create a fund for ongoing assistance to the people of Flint for responding to the impacts of lead exposure. "In discussions with health professionals, they have expressed the need for significant investments in the local health system in order to respond to the widespread exposure of lead to the people of Flint, including monitoring of future lead exposure," the letter says.

That the state immediately reimburse Flint for the \$2 million the city paid as its portion of the cost of reconnecting to the Detroit water system. "Requiring a financially distressed city and its people to pay for the state's failures is an abdication of clear responsibility by the state," the letter says. "The state-appointed emergency manager was in charge of the city of Flint during the time that the decision to leave the Detroit (water) system was made."

Flint reconnected to the Detroit water system last month, but researchers and the U.S. Environmental Protection Agency have said the danger of lead in water here isn't over.

Earlier this month, the EPA said Flint residents should be warned of the potential for increased lead in drinking water when crews perform underground work that can cause scale and sediment containing lead to break free from water pipes.

EPA GROUP TO TAKE TESTIMONY ON FLINT WATER CRISIS AS IT WEIGHS RULE CHANGES (FLINT JOURNAL)

[HTTP://WWW.MLIVE.COM/NEWS/FLINT/INDEX.SSF/2015/11/KILDEE_SCHEDULED_TO_TESTIFY_ON.HTML](http://www.mlive.com/news/flint/index.ssf/2015/11/kildee_scheduled_to_testify_on.html)

By Ron Fonger | rfonger1@mlive.com

on November 17, 2015 at 3:23 PM

FLINT, MI -- Congressman Dan Kildee says he intends to tell the story of Flint's water crisis during testimony to the U.S. Environmental Protection Agency's Drinking Water Advisory

Council on Wednesday, Nov. 18.

"My statement will be largely pushing for EPA to answer whether its oversight is adequate when there is a fairly dramatic change in the source of water," Kildee said.

The Flint Township Democrat said he plans to focus his comments also on what the state and EPA can do to improve drinking water quality in Flint and to restore public confidence in the system.

The EPA is considering changes in the federal Lead and Copper Rule, and a news release from Kildee's office says he will speak in favor of changes aimed at promoting greater transparency and to ensure that another public health crisis doesn't reoccur in Flint.

The public health emergency was declared in Flint despite the city never having been found to be in violation of the Lead and Copper Rule.

Researcher who tested water independent of sampling done by the city have said testing methods allowed under EPA current rules, including pre-flushing of lines in which water is being tested, contributed to artificially low lead readings in Flint.

Last week, the [EPA announced](#) it would audit the Michigan Department of Environmental Quality's water quality program after the state acknowledged it mistakenly never required the city to treat Flint River to make it less corrosive.

Kildee and state Senate Minority Leader Jim Ananich, D-Flint, had [made the request](#) for an audit of the MDEQ.

READ RESIGNATION LETTER OF FLINT OFFICIAL IN CHARGE OF CITY WATER (FLINT JOURNAL)

[HTTP://WWW.MLIVE.COM/NEWS/FLINT/INDEX.SSF/2015/11/READ_RESIGNATION_LETTER_OF_FLI.HTML](http://www.mlive.com/news/flint/index.ssf/2015/11/read_resignation_letter_of_fli.html)

By [Ron Fonger](#) | rfonger1@mlive.com
on November 17, 2015 at 1:20 PM

FLINT, MI -- Howard Croft's [sudden resignation](#) as the city's Department of Public Works director ended his nearly four years in City Hall, and his letter of resignation offers only the most general clues about why he took the step now.

Croft's letter, included here in the photo gallery, says he is leaving his position to help restore public trust following a [lead-in-water crisis](#).

But the written resignation makes no direct mention of any aspect of the health emergency or the decision to use the Flint River as the city's drinking water source.

That experiment, which started April 2014, continued until the city reconnected to the Detroit water system last month. Controversy continues about the long-term damage caused to the city's infrastructure by corrosive river water and about the long-term health fallout of increased levels of lead in drinking water during that 17-plus months.

The Flint Journal-MLive could not immediately reach Croft for comment today, Nov. 17.

MICHIGANDERS SAY FLINT WATER WAS TOXIC (COURTHOUSE NEWS.COM)

[HTTP://WWW.COURTHOUSENEWS.COM/2015/11/17/MICHIGANDERS-SAY-FLINT-WATER-WAS-TOXIC.HTM](http://www.courthousenews.com/2015/11/17/michiganders-say-flint-water-was-toxic.htm)

By DAVID WELLS

DETROIT (CN) - Central Michigan citizens claim in court that a city government put them in danger by exposing them to drinking water with high levels of lead.

Six Flint, Mich., residents filed the federal class action on Nov. 13, seeking class status and damages for prolonged exposure to dangerous water.

The suit, also filed on behalf of four children, alleges that the City of Flint began pumping water from the Flint River in April 2014 to save money, and that the water caused health problems like high levels of copper in blood, hair loss and chronic throat problems.

Soon after the switch, residents began holding public demonstrations, calling for a reconnection to the city's old Detroit water supply, according to the lawsuit.

The city and 14 governmental officials named as defendants ignored growing public concerns over the safety of the water, the lawsuit states.

Defendant Gerald Ambrose, who worked as Flint's emergency manager until April of this year, rejected a March city council vote to reconnect to the Detroit water system, according to the complaint.

The residents also say that Flint officials knew as early as 2011 that the river water was dangerous, and that, without proper additives, it would leach lead and copper from the surrounding pipes.

Despite the warnings, citizens were exposed to water with high levels of lead for about 18 months, and unused anti-corrosive agent would have only cost the city \$60 a day, according to

the lawsuit.

Michael Steinberg, legal director for the American Civil Liberties Union of Michigan, said in a statement that Flint's actions were "harmful and misguided," in addition to being illegal.

"In their short-sighted effort to save a buck, the leaders who were supposed to be protecting Flint's citizens instead left them exposed to dangerously high levels of lead contamination," Steinberg said.

One resident, 52 year-old Rhonda Kelso, claims that she and her special-needs daughter, identified in court documents as K.E.K., drank the toxic water from April 2014 until the fall of 2015.

Kelso claims that she suffered aggravation of her asthma and that K.E.K.'s developmental disorders were worsened by exposure to the water. She also says that her home suffered massive water pipe damage.

Last month, Michigan Gov. Rick Snyder, who is a defendant, ordered to switch Flint back to the Detroit water system. He also formed a task force to better monitor the water situation.

"Transitioning back to the Detroit Water and Sewerage Department-Great Lakes Water Authority is a good first step to protecting public health in Flint, but it's not the last step," Snyder said in a statement. "Bringing in outside experts to evaluate our actions and help monitor and advise on potential changes to law, procedures and practices will be key to continuing work on the comprehensive action plan and ensuring safe drinking water for all the residents in Flint and all of Michigan."

Despite the city and state's recent efforts, the litigating residents say the damage has been done. They want property repairs, the creation of a medical monitoring fund and punitive damages.

The residents are represented by Michael Pitt of Royal Oak, Mich.

FLINT OFFICIALS, EXPERT HIT LEAD CONTAMINATION LAW (DETROIT NEWS)

[HTTP://WWW.DETROITNEWS.COM/STORY/NEWS/POLITICS/2015/11/18/FLINT-WATER/75987558/](http://www.detroitnews.com/story/news/politics/2015/11/18/flint-water/75987558/)

Jim Lynch and Melissa Nann Burke, The Detroit News 11:06 a.m. EST November 18, 2015

Arlington, Va. — Flint area officials and others joined a water quality expert Wednesday in railing against the federal law that they say put city residents at risk of drinking lead-contaminated water during the past year and a half.

Flint's crisis began in April 2014, when the city stopped buying water from the the Detroit Water and Sewerage Department and, in a money-saving move, started drawing its water from the Flint River — a decision that had immediate repercussions. It led to foul odors, strange taste, smell and appearance of the water and later to the discovery in August by a local pediatrician of high levels of lead in children, despite the assurance of state and city officials that the water was safe to drink.

"What happened in Flint is a failure of government," said U.S. Rep. Dan Kildee, D-Flint Township. "People expected the government, at multiple levels, would be able to protect them... And government failed them."

Residents and experts criticized the implementation of the 25-year-old federal Lead and Copper rule Wednesday to the U.S. Environmental Protection Agency's National Drinking Water Advisory Council. The complaints come as lawmakers and regulators consider revisions to the rule, which is receiving increased scrutiny.

"We were constantly being told our water was safe by the city" and the Michigan Department of Environmental Quality, said LeAnne Walters, a Flint resident whose tap water registered severe spikes in the amount of lead when tested earlier this year.

Critics of the Lead and Copper Rule say the legislation does little to protect the public. It allows for water samples to be collected, such as before there is flushing, that reduces the likelihood of lead discovery. They say it provides loopholes allowing cities to comply with federal testing standards regardless of whether the water is safe — leaving the public vulnerable to lead exposure.

After 25 years, the law still has not been implemented and enforced as originally intended, said Marc Edwards, a Virginia Tech civil engineering professor whose water sampling has helped outline Flint's contamination issues and who has criticized Michigan's handling of the Flint crisis.

"What is so disconcerting about this case is that the parents had to figure out ... that their children were being poisoned from the water ... despite assurances from (government) agencies..." Edwards said. "Those oft-repeated assurances about safe water were completely false."

Dr. Mona Hanna-Attisha, a Hurley Medical Center pediatrician who helped uncover rising lead

levels in Flint children, joined Edwards in warning that what happened in her city is likely happening elsewhere around the country.

The severity of lead poisoning, with its impacts on childhood development that can take years and generations to track, make the situation unacceptable, she said.

“When (lead) is in a population, it’s damning, absolutely damning,” Hanna-Attisha said. “And it’s preventable.”

mburke@detroitnews.com

(202) 662-8736

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FLINT DRINKING WATER CLIPS

US. EPA REGION 5 – AS PREPARED BY PETER CASSELL (ORA/OEC/PA) ON DEC. 2, 2015

In Flint, lead contamination spurs fight for clean water (Michigan Daily)

Flint mayor outlines her goals for her 1st 100 days in office (Michigan Radio)

IN FLINT, LEAD CONTAMINATION SPURS FIGHT FOR CLEAN WATER (MICHIGAN DAILY)

<https://www.michigandaily.com/section/news/water-and-all-flints-ghosts>



The Flint Water Plant is quiet now that all of the Flint River water has been emptied from the plant and the city returns to Detroit Water.

Ruby Wallau/ Daily

Sam Gringlas

Managing News Editor

Wednesday, December 2, 2015 - 3:01am

FLINT, Mich. — On a Saturday evening in October, several hundred trick-or-treaters streamed up and down Calumet Street on the city's east side. Traffic clogged the neighborhood's streets, lined with well-maintained Tudors, Colonials and mature trees cloaked in hues of red and yellow. Princesses, ninja turtles, witches and firemen darted between the cars, and on their front lawn, Bob and Melodee Mabbitt passed out candy from beneath a rain umbrella. The Mabbitt's stretch of Calumet is wealthier than most of Flint's neighborhoods, and draws kids from all over town on Halloween. But this year, along with Snickers, Crunch bars and boxes of Nerds, the Mabbitts were handing out leaflets.

The letters were bold and black, and they warned Flint parents their kids may have been

exposed to toxic lead from their drinking water. "You are getting this as a courtesy to let you know that one or more of your neighbors had their tap water tested and was informed they have very high contents of lead and other pollutants in their water," the fliers read. Nayyirah Shariff, a Flint community organizer and friend of Melodee's, slid the white, folded fliers into dozens of old pillowcases and plastic buckets shaped like jack-o'-lanterns. "Don't worry, there's candy, too," she assured a group of kids clad in raincoats. "Happy Halloween!"

In October, Michigan Gov. Rick Snyder (R) announced the city of Flint's drinking water contained elevated levels of lead. A local pediatrician's report the week before had shown a significant jump in the number of Flint children with elevated blood lead levels, and those samples correlated with ZIP codes in which independent water samples pointed to lead contamination. State officials initially discounted the data. Eight days later, they reversed course. The city would again source its water from the Detroit River. For the residents of Flint, it was too little, too late. They had been ringing the alarm over the city's water quality for more than a year, almost immediately after the city opted to treat its water in-house from the Flint River.

Flint had already planned to join a new pipeline, the Karegnondi Water Authority, which would eventually serve mid-Michigan and the state's thumb. Knowing Flint had plans to leave, Detroit's water authority said it would stop supplying water to the city. At the time, Flint was under the control of a state-appointed emergency financial manager who, in a cost-saving move, decided that while the city waited for the KWA to come online, Flint would treat its own water for the first time in decades. Residents say officials brushed off their concerns again and again. They reported that water ran from their sinks discolored in browns, blues and yellows. Then came the hair loss, rashes that wouldn't go away, rotting teeth, discolored shower tiles. In July, the city's mayor drank a glass of water on local morning television to prove the water was safe. It wasn't.



Flint resident Lee Walters shares a photo of herself holding up a water sample taken from her sink during a city council meeting.

Ruby Wallau/ Daily

Melissa Mays, a Flint mother of four, had brought us here, to Calumet Street. Mays, her husband, and their four sons were all diagnosed with lead poisoning last year, and she's spent months

working with Shariff, clergy members, activists and a ragtag collective of Flint residents to pressure the city, the state, the feds — anyone, really — to do something. In their living room, about 10 minutes from Calumet, Mays' husband applied zombie makeup to all four kids, his own face and hands already covered in the white, red and black paint. Two candelabras decorated to look like they were covered in spider webs sat atop a tablecloth patterned with skulls. I slid into a chair next to Derek and Ruby, the Daily columnist and photographer who joined me on the trip. A row of electric guitars hung vertically across one wall, and another was plastered with the kids' drawings and class projects. Mays and Shariff, who had come over for the interview, were seated on the table's long side, and I asked how the whole debacle started. Mays spoke with dizzying speed, peppering a timeline of the last two years with talk of trihalomethanes, parts per billion, Freedom of Information Act requests and the federal Lead and Copper Rule. Mays is not a scientist or policy analyst, but it was apparent that, out of necessity, this research has ended up a full-time endeavor.

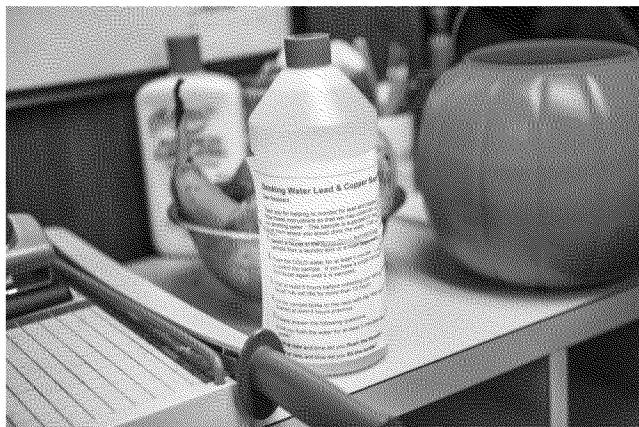
Not long after water started flowing from the Flint River and into taps and showerheads across the city, residents started noticing their water running yellow and brown. It smelled funny, and tasted strange, too. People were showing up at Flint City Council meetings displaying bottles filled with the brown-colored water. "It's a quality, safe product," Flint Mayor Dayne Walling said at the time. "I think people are wasting their precious money buying bottled water." Four months later, water on the city's west side tested positive for E. coli, and the city issued a series of boil-water advisories. Shariff said she only came across the alerts accidentally when clicking around the city's website; Mays said she didn't hear about them until after the third advisory.

By September 2014, Mays had enough; she was convinced the problem was more than just bacteria. She said her cat was throwing up, her own hair was falling out and a splotchy red rash had started to stretch across her face. Mays' 2-year-old niece was staying in the house then, and every time she took a bath, the toddler broke out with a rash all over her behind. The rash covered only the body parts where the tub's water hit. Eczema cream didn't help, and the child's doctor couldn't figure out what was wrong.

"And I'm like, 'What is happening to this kid?' The rest of us were just used to it. Our skin was turning scaly," Mays said. "My son — my middle child — just had rashes up and down his arms, and if you tried to put lotion on it — it just burned. It was chemical burns. It was on my face, my whole cheek bone. And any time you put anything on it, even makeup, you would just scream because it hurt so bad. But they're on T.V. saying, 'Water's safe, water's safe, water's safe.' "

AUDIO: Hear Flint residents talk about their experiences with city water.

In January 2014, the city distributed a letter notifying homeowners that the city had violated the federal Safe Drinking Water Act — not for lead, but for total trihalomethanes. The city's



water was found to contain a high level of trihalomethanes — a cancer-causing chlorine byproduct. By this point, members of City Council called on the governor's appointed emergency manager to abandon the Flint River water source, and the city of Detroit offered to start selling water to Flint again. But Flint's emergency manager opted to stay the course. To investigate, residents called in a water activist, who told Mays not only that she shouldn't drink the water, but

that she shouldn't cook or shower with it either. And if the city didn't have a lead problem now, he said, they would soon. Mays didn't know it at the time, but they already did.

"When you're boiling the water to make spaghetti, you're just making all of those heavy metals and all the contaminants basically bond together, and you're basically eating poison food. When you wash your clothes, the heavy metals stay in the fabrics so it's rubbing against your skin all day and god forbid you sweat, you're going to absorb all of that through your pores. So I can't wash my dishes here, I can't do my laundry, I can't move because I'm 16 years into a mortgage and nobody's going to buy my poison water house."

Mays takes us into the kids' bathroom. A five-step instruction sheet for showering was taped to the wall, written by Mays in neat, black marker. Step Two: Sit down and as the tub fills, use the cup and faucet to wash your face and hair. Rinse well. Step Four: Brush your teeth in the sink using bottled water and small cups. Don't forget Q-tips. "Love You!" is scrawled and underlined across the bottom. Next to it another reminder: "Brush Your Hair!" I asked how the kids took to the new routine. "It makes them angry, and then once we found out about the lead, I took out the letting the water fill up, so they just used a big cup to let it go over their heads," she said. "So yeah, my 17-year-old son just loves that, to sit down and use a cup to shower and to use bottled water to brush their teeth."

Mays brought in an outside expert to test the water — Marc Edwards, a professor at Virginia Tech University who specializes in water treatment. She said she drove 62 of the test kits to neighborhoods across Flint, picked them up and helped residents complete them. The lead levels in water at Flint resident LeeAnne Walters' house was averaging 2,500 parts per billion. Her family was losing hair and developing rashes, too. The legal level is 15. In a September 2015 report, Edwards concluded that the corrosiveness of Flint's water was causing lead to leach from the city's aging pipes and into the water. The state maintained it was meeting all lead and copper standards.

An empty lead and copper water sampling bottle in the office of the The Flint Water Plant.

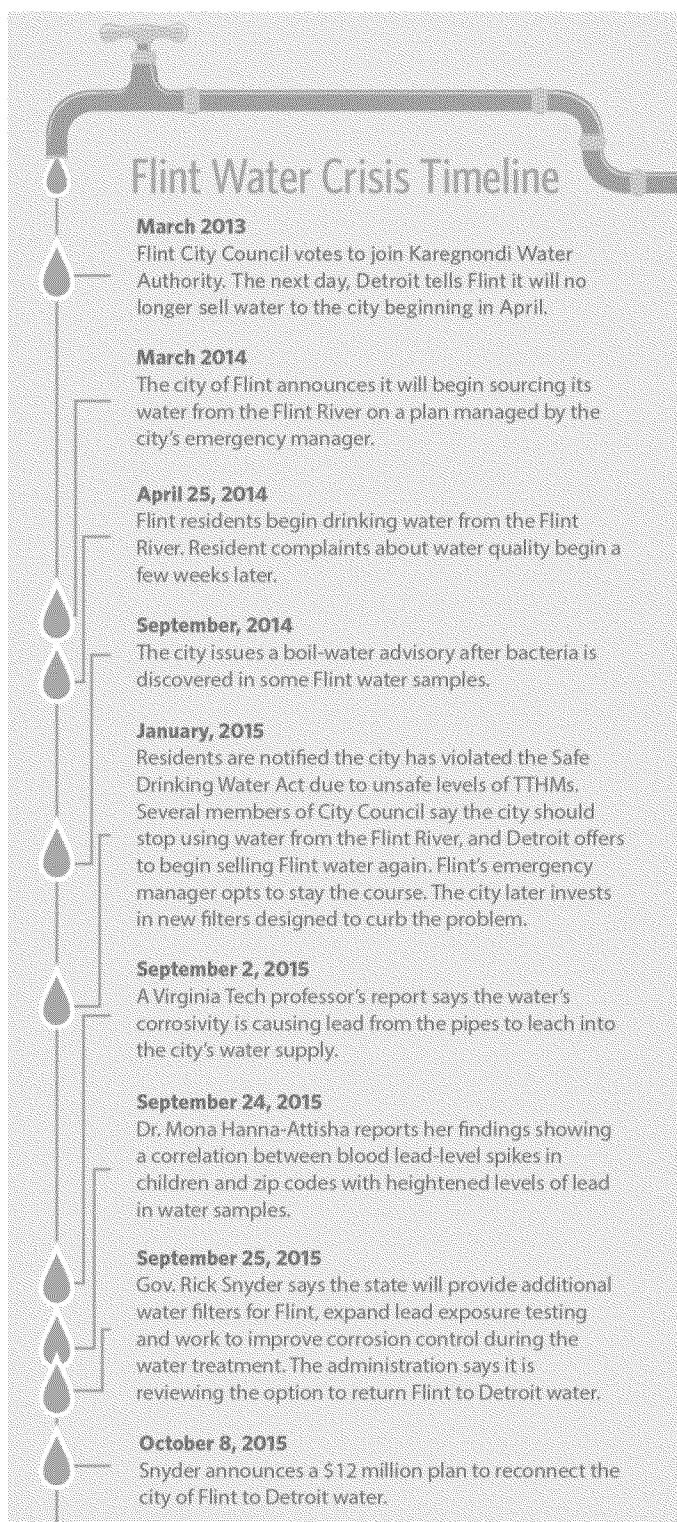
Ruby Wallau/ Daily

On Sept. 24, Dr. Mona Hanna-Attisha, a University alum and a pediatrician at the Hurley Medical Center Children's Clinic in Flint, cross-referenced that data with information the county already had — blood lead levels for infants at ages 1 and 2, which the state is required to test for kids who are at a greater risk of ingesting lead paint chips in older homes. What she found: The number of children in Flint with elevated blood lead levels — defined as 5 micrograms per deciliter or more — had increased from 2.1 percent in the 20 months prior to Sept. 15, 2013, to 4 percent between Jan. 1 and Sept. 15, 2015. In several ZIP codes, those figures increased from 2.5 percent to 6.3 percent during that same time period.

"Everyone who has challenged the narrative — which was 'the water is safe to drink' — they were minimized," Shariff said.

But the evidence built up, and eventually it was hard to ignore there was a problem. Finally, on Oct. 8, 2015 — nearly two years after Flint residents started drinking water from the Flint River — the state changed course and announced they had come up with a \$12 million deal to allow the city to return to Detroit water. "I'm in full support of the return to the Great Lakes Water Authority," Snyder said during the announcement. "We all care about the citizens of Flint." Snyder promised to convene a task force — which includes a University professor and several University alums — that would determine what went wrong. Detroit water would again run through Flint's pipes, and Flint's parents could rest easy knowing their kids' drinking water was safe.

But Mays says people shouldn't be so quick to chalk the case up as a crisis averted. The story of water in Flint is not confined to that period of two years when the city's water was unsafe for drinking — or by the final hurrah moment in October when the good guys fighting the good fight won the day. Flint's challenges also reach further, into a history colored by the population loss and decay that made it easy to brush the city aside, as well as into a future that these two years will in many ways shape.



A timeline of Flint's water struggles.

Design by Emily Schumer

On the banks of the Flint River

You could argue the city of Flint, like a lot of cities, was born from the river. The confluences between city and water stretch back far — to a time when native people fought over the river's banks. A handful of fords, where the river could be easily traversed, made the land highly sought after. In 1819, before the great industrial might of Buick City generated wealth and helped the city's population grow, and before the city's slide into poverty and decay, a fur trapper and his wife set up a post near the river's banks. For the traders who came here — and to Michigan, a territory hugged on four sides by the Great Lakes — water was life-giving. The rivers provided habitat to beavers, and the water ferried birch-bark canoes downstream, piled up with pelts for sale back East and across the vast Atlantic.

In later years, Michigan's rivers and lakes were clogged with logs, floated downstream for processing into lumber that would build this nation's cities. The water fed the state's growing agricultural economy as well as the companies that empowered the United States' industrial might — industries that allowed old lumber towns across the Rust Belt to boom, before they would hemorrhage wealth and population a few decades later. Today, water is the basis for Michigan's wildly successful "Pure Michigan" advertising campaign, which helps drive the state's vibrant tourism industry in the towns dotting Lake Michigan. For a whole lot of Michiganders, their Michigan and their Midwest does not include the vast and aging networks of pipe that snake beneath the earth, nor the sediment-colored water of the rivers Rouge, Flint, Detroit and Saginaw.

"We connect to water very emotionally, we love our water, it's Pure Michigan, it's why that ad campaign really sings to us," John Austin, a University of Michigan lecturer and co-author of a report on Michigan's 'Blue Economy,' told me during a phone interview later in the week. "And so we appreciate that even more than this hidden water infrastructure that brings us clean water and is essential to basic life and health."

Today, one in five jobs in Michigan are linked to water, and Austin said the state could play a major role in developing innovative ways to use water more efficiently, particularly as water resources grow increasingly strained. But as much as Michiganders — residents of a state whose surrounding Great Lakes contain 20 percent of the world's surface freshwater supply — love their water resources, Austin says it's easy to forget about the hidden infrastructure that delivers fresh water to taps on demand.

"What Flint really illustrates is ... as a first order of business, we depend on water for life and that water has to be clean and available to people," he said. "What Flint exposed is our water infrastructure — that in every community in Michigan we've got aged infrastructure and this

shows that since we haven't invested in remaking our water infrastructure — in rebuilding those systems — they can potentially kill us.”

For Austin, this dynamic illustrates the need to invest not only in infrastructure above ground, such as roads and bridges, but also in the infrastructure that sits below the surface. With debate over paying to fix Michigan's roads reaching a boiling point last spring, Austin said people should be just as concerned with the invisible infrastructure — particularly the pipes that shepherd clean drinking water into our homes every day.



The Flint Water Plant is quiet now that all of the Flint River water has been emptied from the plant and the city returns to Detroit Water.

Ruby Wallau/ Daily

Through the pipes, below the ground

After Halloween, I spent a week trying to get into Flint's water plant. When I spoke to Mike Glasgow, the city's utilities director, on the phone, he told me how excited he was to hear young people were interested in municipal water delivery. But in the days leading up to the final reporting trip to Flint, the woman who handles his schedule kept telling me to call back later; she hadn't had a chance to nail anything down. By Thursday evening, I wasn't getting any response at all. I decided I would just show up at the facility anyway.

The Flint Water Treatment Plant sits on a sprawling campus just off the freeway. The complex is circled with tall chain-link fencing topped with barbed-wire spirals. A long driveway leads up to the main building, which is sand-colored and doesn't boast much in the way of decorative finishes. A white water tower hulks above the building, around which another half-dozen smaller structures are gathered. Only a handful of cars congregated in the parking lot, and a sign in one of the front windows indicated the office entrance is around back. Inside, the plant's office was drab and dated. Paper maps hang on the paneled walls, and a collection of empty lead and copper water sampling bottles rest on a shelf nearby. I found Brent Wright, the plant's supervisor, in an office lined with dozens of binders. Wright looked understandably confused when we enter. “Hi, we're here for a tour of the plant,” I said enthusiastically. “Mike knows we're coming.” I only half-lied. I started to sweat a bit when he dialed up Glasgow to make sure the story checked out, but when Wright hung up the phone, he told us, “The best place to start is from the beginning.”

Flint's first water treatment plant was built in 1917. The original red brick building stands a few hundred yards from the present facility, and looks a lot like an abandoned automobile factory. Many of the square panes of glass are smashed in, and Wright tells me the roof collapsed a few years back. The city built a second facility, the current plant, in 1952, but it would only operate fully until 1967, when the city stopped treating its own water and started buying it from Detroit. During the peak of Flint's prosperity and population, when sprawling factories turned thousands of GM cars off production lines, both plants together pumped 100 million gallons of water per day. Today, with most of those factories shuttered and the city's population significantly depleted, the Flint plant was only pumping about 16 million gallons daily when it last operated in October. In 1960, 196,940 people lived in Flint, according to the U.S. Census. Today, 99,002 people call this 33-square-mile city home.

With the city back on Detroit water, there wasn't much going on inside Flint's water treatment plant during the visit. The final gallons of Flint River water had just been emptied out the week before. A few construction workers wearing hard hats moved through the massive building's darkened cement corridors, getting the place ready for the KWA pipeline to go live a few years down the road. The process for cleaning and distributing water is not incredibly simple. Wright is well versed in it after 25 years working his way up at the plant. First, the water is pumped from the river. Until it's pumped back out of the factory as clean drinking water, that's the only part of the process that isn't propelled by gravity. From there, the water is lifted into chambers for ozone treatment, created by putting together electricity, oxygen and nitrogen, which kills much of the bacteria.

The Flint Water Plant is quiet now that all of the Flint River water has been emptied from the plant and the city returns to water from the Detroit river.

Upstairs, where generators create this ozone, I asked why didn't the plant know there would be a corrosion problem, and add corrosion control into the process. Water is corrosive by nature, but after years of industrial waste dumped into the river, it was especially so. "Basically, by being a softening plant, we didn't think we were going to need corrosion control," Wright said. "It was brought up in a meeting and the DEQ said, 'No, let's wait and see what your lead and copper sampling is and then we'll look into corrosion control.'" Wright went on to say that the switch back to Detroit was unnecessary and that the city could have handled the problem on its own. "Yeah, we could have taken care of it," he said. "We're doing it now. We're setting up corrosion control now because they're saying this water has stripped some of the heavy phosphates out of the pipes over this last year that had built up when we were on Detroit water, so we're adding more phosphates."

Wright led us through the plant's laboratory, where glass jars, beakers, lab coats and clipboards lined the walls. From there, we followed a series of dim hallways into a massive room where

sediment is removed from the water. A catwalk stretched across a giant reservoir-like chamber I figured could hold the water of several dozen swimming pools. Without the lights on, seeing the bottom proved difficult, even as we moved across the walkway suspended directly over it. Back when water was still held here, enormous paddles would have rotated through the water, pushing sediments to the bottom and separating them from the clean water. Peering down into the empty vat felt like standing on a deserted basketball court after the floodlights have been turned off and the crowds have all gone home.

While Wright kept talking about turbidity, lime and filtration, I couldn't get over the bigness of the whole thing — not only the millions of gallons that once moved through this place each day, but also the weightiness of the task at hand. That charge — to ensure the safety of the water that makes its way into your toddler's bathtub, mixes your baby's formula and washes down your grandpa's heart medicine — is clearly a heavy burden, a task that's unquestionably important to get right.

Policy failure

The debate over what happened in Flint will likely continue for some time. The governor has convened an independent task force to investigate, and the EPA is releasing their own report on the situation. A recent Michigan Radio [report](#) suggested the state told city officials to leave two incredibly high water samples off their official water test report — allowing recorded lead levels in the water to remain below the legal threshold. Many of the sources said they thought officials should be fired, and some should get jail time for what happened in Flint. I had hoped to ask Walling, Flint's mayor, about all of this, but his press secretary instead offered Howard Croft, head of the city's Department of Public Works. Walling had the day before received an early punishment from the city's residents: His bid for re-election was defeated.

A few days after Croft asked to reschedule the interview, he resigned. "It is with deep sadness that I tender my immediate resignation," the longtime Flint resident appointed to oversee the water switch wrote in a statement. "With the city engaged in transition and working to regain public trust, I believe that now is the right time for me to step down from this position."

It's hard to argue that elected and appointed officials didn't majorly drop the ball on a lot of levels. Whether that's the result of negligence, malintent or political weakness, people disagree. Edwards, the Virginia Tech professor, says it was the Michigan Department of Environmental Quality's job to ensure the city managed the switch appropriately. Glasgow, the utilities manager, said the state told him to take two particularly high samples off his report. "They instructed me to take it off the report," he [told](#) Michigan Radio in October. "I don't know that I can give you a good enough answer to tell you why they decided to remove it from the report." The house those samples came from? LeeAnne Walters'.

Walters said the city was also padding its reporting with loopholes in the federal Lead and Copper Rule that allowed the city to pre-flush the water for five minutes before taking a sample and to use narrow-mouthed bottles that required a slower water stream and wouldn't show accurate lead readings. She said those loopholes must be closed, and she's already lobbying government officials to do so. A Detroit pastor recently filed an unsuccessful petition with the state Board of Canvassers to get a proposal on the ballot to recall Snyder for his failure to intervene in the water crisis. Several lawsuits have also been filed, including one in which Mays is listed as a complainant and another [class action suit](#) against Snyder, Walling and 10 other state and local officials, including Croft and Glasgow.

"What (we) would say is that we're focused on moving forward and ensuring public health and clean, safe drinking water," Snyder's press secretary Sara Wurfel told The Flint Journal after the filing. "The governor has outlined a detailed multiple step action plan for both immediate, mid and long term."

No resignations are going to alleviate the scars left by lead. But as finely woven as this issue is — with complicated timelines, players and literal chemical equations — maybe it's actually pretty simple. Government officials messed up big time, and a majority Black city with some of the state's poorest residents had to pay for it. No matter how you spin it, public policy failed. Officials did not serve the people they had promised to protect.

I thought about what Walters said at her kitchen table when I asked her whether she thought the mayor didn't step in because he didn't want to or because he didn't have enough power to do anything. "That's a loaded question," she told me. "I've debated that with people many times. I always get the, 'Well, in politics...' Well I don't want to hear about politics. Every politician has a human side, and I don't care what the politics of it is. Knowing that children were being poisoned, you stand up and you do what's right, and if you don't do that, then you don't deserve to hold the position that you have. You are there because the people put you there. You should be doing what your citizens need to do. Even if you don't have the power to make a change, you have a voice, you stand with your people."



Flint resident Lee Walters demonstrates the slow water stream used by the the city to pad its federal Lead and Copper tests in her relatives kitchen on Nov. 6, 2015.

Ruby Wallau/ Daily

Beyond all the blame passing, if we can't expect and trust that our drinking water — a resource people literally can't live without — will be clean and safe, then Flint residents have started asking who and what can we trust? I would imagine that's what a lot of folks in Flint are thinking through when they wake up to brush their teeth or wash their faces before bed. And that has incredible ramifications.

"I think there's a serious trust issue in this community," Hanna-Attisha said. "We're in 2015, we're in the middle of the Great Lakes and we don't have access to safe drinking water. And we trust that our government regulates these things. There's rules that will ensure that public health is protected. It's mind-boggling that it's not. And if these rules are not going to be strengthened or enforced, then the public needs to take it on their own to make sure that they have access."

In Flint, change occurred when residents, not public officials, called foul. "Our residents were complaining for months and months that their water was brown, it smelled bad, it tasted bad, there was E. coli in it and in other communities with louder, more affluent voices, it wouldn't have lasted this long," Hanna-Attisha said.

I asked Mays if she thought this would have happened in a place like Bloomfield, Ann Arbor or Farmington Hills, the city where I'm from. With a median household income of \$24,834, Flint is a city where 41.5 percent of residents live below the poverty line. She cut in before I could finish. "No."

"People don't want to acknowledge that there's been a problem," Shariff said. "This isn't like a hurricane where stuff is happening that you have no control over. This isn't an act of god."

Mays interrupts her. "This problem is man-made."

Though the problem was finally illuminated, it was not by government regulators, health officials or elected leaders, but by regular people like Mona Attisha-Hana, Melissa Mays and LeeAnne Walters. Attisha-Hana is a pediatrician. Mays does PR for a radio station. Walters is a stay-at-home mom. The community forced action from the city and state. Sure, residents acted with the interests of their own kids in mind, but also seem to have been driven by something bigger: by a sense that they owed something to their neighbors.

I wonder whether the dynamic in Flint — where the community was forced to serve as sole government watchdog — will simply become the new paradigm there, or whether the events of the last two years will spur some kind of wake-up call reverberating through city halls, water treatment plants, statehouses and governor's mansions all across the country.

Future in Flint

For Mays, the switch back to Detroit water hasn't changed much in her day-to-day life. The family still runs all their drinking water through a blue filter they keep on the fridge's top shelf. The corrosive river water likely wore away the phosphate coating on the city's lead pipes — and that could take years to build back up again. There are also the physical markers left by lead.

"Well now, my kids got to get tutors," Mays said on Halloween, as her kids prepared their costumes in the next room over. "I talked to my son's teacher this week and he's struggling in algebra, something he did great in before all this. My youngest, same thing. My middle child, has since he was younger, they've always wanted to bump him up, bump him up. He's got his first C and I'm beyond furious. Not to mention the physical things. My oldest has two holes in his teeth, on the smooth sides. That doesn't happen unless your teeth are crumbling from the inside out and the dentist said that's because of the lead poisoning. And they're all adult teeth, so what's he supposed to do, get dentures? And then the fact that my son fell off his bike and he had two buckle fractures on his wrist from catching himself, just falling over. That means his bones are weak. He complains all the times about how his bones hurt. 'My back hurts, my leg hurts, Mom.' Because you have severe bone pain with lead poisoning and I've got the same thing.

"I feel horrible. I want to help them, and there's nothing I can do as a mother and that infuriates me because people did this to us, people allowed it to continue to happen, they didn't speak up. The citizens who are sick spoke up and that's not our job, but it's become our lives and there's people worse off than me who can't afford the medications, can't afford the extra doctors."

Hanna-Attisha says the costs of Flint's water debacle will have ripple effects decades and generations down the road.

"When the kid is 5, they're going to need special education, when that kid is 10, they're going to get an ADHD diagnosis and have behavior problems," Hanna-Attisha told me during one of our telephone conversations. "And when that kid is 16, they're going to have problems with the criminal justice system. Imagine what that does to an entire population. So we have just shifted the entire population curve — their IQ curve. We've lost all of our high-achieving 130 kids who are going to go to U-M, who are going to come up with the next cure for cancer and we have now tons more kids with low 70 range who need more remedial services. As a population, it is absolutely damning. The state thinks they solved the problem when they went back to Detroit water. The money they gave is a down payment. This is a long-term problem."

"Those are dreams derailed," Shariff told me. "Because people have hopes and aspirations and because being exposed to lead and copper, they're going to have to create a new paradigm."

Whether lead poisoning will necessarily land a whole generation of kids in jail, it's hard to know. But a lot of the problems wrought by Flint's water crisis aren't going to fade away easily. Their appearance in The New York Times, and on the policy agendas of government officials very well might, but the physical and emotional ramifications will likely linger for a long time. Walters, who recently relocated to Virginia but returns to Flint to keep stoking the fight for clean water, isn't letting her kids drink the tap water in their new home. Not until it's tested, at least. Even outside of Flint, one of her sons has started asking whether the water is safe to drink each time he wants to drink a glassful.

By 7:00 on Halloween, the rain wasn't letting up on Calumet Street, and it was starting to get dark. Mays asked if we wanted to walk with her for a while longer. Mayor Walling, who lives a couple blocks over on Court Street, was up for re-election on Tuesday, and Mays had plenty of door hangers to hand out for that cause, too. I was hungry and needed to go to the bathroom, so we declined. I didn't want to do any of those things in Flint, in the city where the water had been poison.

We got in the car, set the GPS for home, and left Calumet. We left the Mays family, the trick-or-treaters, the Flint River and the whole city behind us. Our Chevy barreled down U.S.-23 toward Ann Arbor — where that night I would turn on my faucet to wash my hands, fill my lazily cleaned pots with water, rinse off dishes stained with Prego and then let the shower's hot water pour over my face, settling into the metal drain below my bare feet. I envisioned the water rushing through the walls and then under the city's streets, houses and parking lots, moving through the pipes like some kind of trick-or-treat ghost.

FLINT MAYOR OUTLINES HER GOALS FOR HER 1ST 100 DAYS IN OFFICE (MICHIGAN RADIO)

<http://michiganradio.org/post/flint-mayor-outlines-her-goals-her-1st-100-days-office#stream/0>

By [Steve Carmody](#) • 20 hours ago

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Flint's new mayor has laid out her priorities for her first hundred days in office. Not surprisingly, the plan largely reflects the issues she stressed in her campaign.

"I'm not trying to do it by myself," Flint Mayor Karen Weaver told a small audience at city hall, "I need all of you, and the people that are out there, to help."

Credit Steve Carmody / Michigan Radio

Karen Weaver defeated incumbent mayor Dayne Walling in last month's election. She's been on the job for nearly a month.

Even though roughly a quarter of her first hundred days have passed, the mayor says now was a good time to update people on her plans for her first 100 days.

A top priority for the mayor is having Flint's problem plagued water system declared a federal disaster. The decision to switch the city from Detroit water to the Flint River lead to numerous problems, including high lead levels in the drinking water.

Mayor Weaver says she's talked with Michigan U.S. Senators Debbie Stabenow and Gary Peters about the problem. She hopes to recruit other congressional and state lawmakers to help lobby for the designation.

Along with fixing Flint's water, Weaver says during her first hundred days she wants to make progress toward returning the city to total local control.

Flint was run by an emergency manager, appointed by the governor, for much of the past four years. The last emergency manager left in April. But decisions by elected city officials can still be overruled by a transition advisory board. Weaver hopes to hasten the end of that last level of state oversight.

Weaver says there are other issues she wants to address during her first 100 days in the mayor's office, including a review of Flint's still wobbly city finances and the creation of programs for the city's children.

Weaver admits not everything in her 100 day agenda will be completed in her first 100 days. She also admits she needs help.

"I'm not trying to do it by myself," Weaver told a small audience at Flint city hall, "I need all of you, and the people that are out there, to help."

###

To: Grevatt, Peter[Grevatt.Peter@epa.gov]
From: Culp, Rita
Sent: Thur 12/3/2015 9:43:21 PM
Subject: Flint Report Language

Hi Peter,

I'm so sorry to bother you. I have just been directed to pull together draft report language on Flint in the next 20 minutes. Not ideal!

Can you read what I've written and let me know if you want changes? Feel free to offer edits that make it sound better.

Flint, Michigan Lead in Drinking Water. – In October 2015, a public health emergency was declared for Flint, Michigan due to dangerously high lead levels in the City of Flint's drinking water. The Committees note that EPA has established the Flint Safe Drinking Water Task Force to provide the Agency's technical expertise through regular conversations with designated officials from Michigan Department of Environmental Quality and the City of Flint. Formation of the task force is a positive and necessary step; however, in order to successfully resolve the lead crisis, funding for emergency technical assistance is necessary. The State of Michigan administers Drinking Water State Revolving Fund (DWSRF)resources through its Department of Environmental Quality. The Committees recommend that the state investigate the use of its set-aside funding from the DWSRF to conduct monitoring and provide technical assistance. EPA is directed to expedite review of such requests from the State of Michigan, and, if deemed appropriate modify the state agreement to ensure funds are made available as quickly as possible.

Thanks,
Rita

To: Darman, Leslie[Darman.Leslie@epa.gov]
From: Google Alerts
Sent: Thur 12/3/2015 9:44:04 PM
Subject: Google Alert - flint water

flint water

As-it-happens update  December 3, 2015

NEWS

WNWN-FM

First Tests Conducted in Wake of **Flint Water** Scandal

WNWN-FM

Free **water** filters and replacement cartridges are still being made available to **Flint** residents by the state after tests this fall found high lead levels ...

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The Detroit News

State: 30 **Flint** residents have elevated lead levels

The Detroit News

Blood tests were administered to 1,361 **Flint** residents starting Oct. 1 as part of the state's action plan for dealing with the city's contaminated **water** ...

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To: Distefano, Nichole[DiStefano.Nichole@epa.gov]; Walsh, Ed[Walsh.Ed@epa.gov]
Cc: Davis, CatherineM[Davis.CatherineM@epa.gov]; Blizzard, James[Blizzard.James@epa.gov]; Bergman, Ronald[Bergman.Ronald@epa.gov]; Greene, Ashley[Greene.Ashley@epa.gov]; Clark, Becki[Clark.Becki@epa.gov]
From: Grevatt, Peter
Sent: Thur 12/3/2015 10:18:35 PM
Subject: FW: Flint Report Language

FYI, just returned from a meeting and found this waiting for me. My suggested edits are shown in blue below. Please let me know how you would like to close the loop with Rita. Thanks, P.G.

Flint, Michigan Lead in Drinking Water. – In October 2015, a public health emergency was declared for Flint, Michigan due to dangerously high lead levels in the City of Flint's drinking water. The Committees note that EPA has established the Flint Safe Drinking Water Task Force to provide the Agency's technical expertise through regular conversations with designated officials from Michigan Department of Environmental Quality and the City of Flint. Formation of the task force is a positive and necessary step; however, in order to successfully resolve the lead crisis, funding for emergency technical assistance is necessary. The State of Michigan administers Drinking Water State Revolving Fund (DWSRF) resources through its Department of Environmental Quality. The Committees recommend that the state investigate the use of its set-aside funding from the DWSRF to conduct monitoring and provide technical assistance to the city of Flint. EPA is directed to expedite review of any such requests included in an amended DWSRF intended use plan from the State of Michigan, and if deemed appropriate, approve of the amended plan to ensure funds are made available as quickly as possible.

From: Culp, Rita [mailto:Rita.Culp@mail.house.gov]
Sent: Thursday, December 03, 2015 4:43 PM
To: Grevatt, Peter <Grevatt.Peter@epa.gov>
Subject: Flint Report Language

Hi Peter,

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Thanks,
Rita

To: Grevatt, Peter[Grevatt.Peter@epa.gov]; Walsh, Ed[Walsh.Ed@epa.gov]
Cc: Davis, CatherineM[Davis.CatherineM@epa.gov]; Blizzard, James[Blizzard.James@epa.gov]; Bergman, Ronald[Bergman.Ronald@epa.gov]; Greene, Ashley[Greene.Ashley@epa.gov]; Clark, Becki[Clark.Becki@epa.gov]
From: Distefano, Nichole
Sent: Thur 12/3/2015 10:21:13 PM
Subject: RE: Flint Report Language

Thanks Peter. Ed and I can take it from here.

Nichole Distefano

Acting Associate Administrator

Office of Congressional and Intergovernmental Relations

Environmental Protection Agency

(202) 564-5200

Distefano.Nichole@epa.gov

From: Grevatt, Peter
Sent: Thursday, December 03, 2015 5:19 PM
To: Distefano, Nichole <DiStefano.Nichole@epa.gov>; Walsh, Ed <Walsh.Ed@epa.gov>
Cc: Davis, CatherineM <Davis.CatherineM@epa.gov>; Blizzard, James <Blizzard.James@epa.gov>; Bergman, Ronald <Bergman.Ronald@epa.gov>; Greene, Ashley <Greene.Ashley@epa.gov>; Clark, Becki <Clark.Becki@epa.gov>
Subject: FW: Flint Report Language

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Deliberative Process / Ex. 5- internal draft edits

From: Culp, Rita [<mailto:Rita.Culp@mail.house.gov>]
Sent: Thursday, December 03, 2015 4:43 PM
To: Grevatt, Peter <Grevatt.Peter@epa.gov>
Subject: Flint Report Language

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appropriate modify the state agreement to ensure funds are made available as quickly as possible.

Thanks,
Rita

To: Darman, Leslie[Darman.Leslie@epa.gov]
From: Google Alerts
Sent: Fri 12/4/2015 7:44:03 AM
Subject: Google Alert - flint water

flint water

As-it-happens update ▢ December 4, 2015

NEWS

8570

Blood tests from 1361 **Flint** residents show 2 percent with elevated lead level, says state

The Republic

Flint has trouble with lead because corrosive **water** from the **Flint** River was ... Michigan health officials say 21 children and nine adults in **Flint** had ...

[Flint residents have elevated lead levels - ChronicleDaily.com \(blog\)](#)

[Full Coverage](#)



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From: Google Alerts
Sent: Fri 12/4/2015 9:44:03 AM
Subject: Google Alert - flint water

flint water

As-it-happens update  December 4, 2015

NEWS

[David Price Photo](#)

Flint residents have elevated lead levels

ExaminerPost.com (blog)

The state health department has been providing free **water** filters and replacement cartridges to **Flint** residents. Late this summer, independent ...

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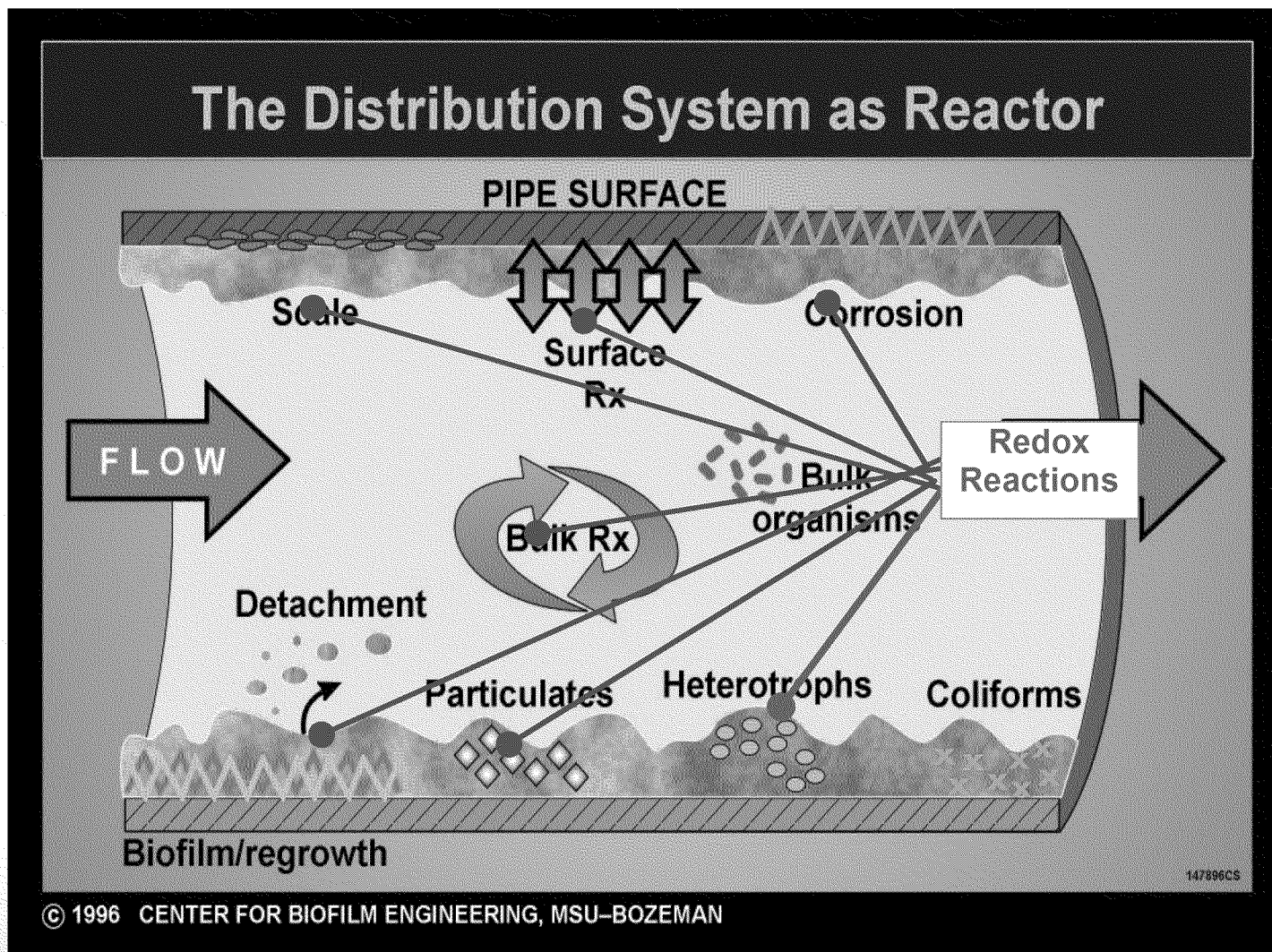


Main Points

- Corrosion, metal release, and transformation in the distribution system to tap
- Sources of lead in household plumbing
- Intentional central water treatment approaches for lead release control, and some accidental deposits that influence it
- Two minute overview of the Lead and Copper Rule and why it should NOT be assumed to be protective at an individual house
- Diagnostic sampling approaches to identify sources
- Thoughts on approaching exposure evaluation



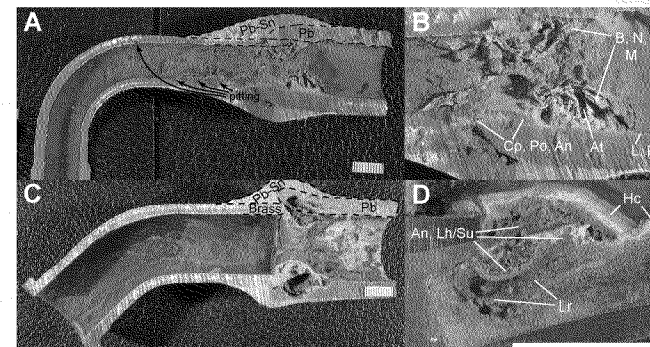
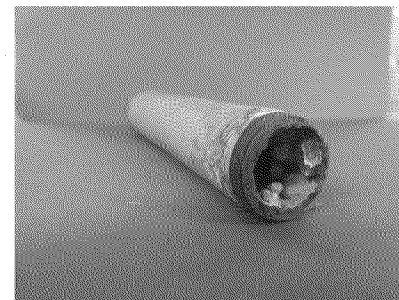
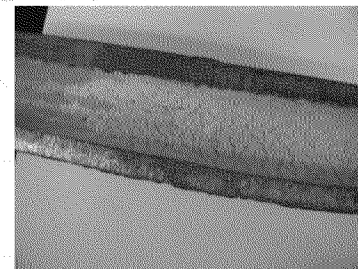
DS = A Long Longitudinal Reactor





Types of Corrosion of Concern

- **Uniform corrosion**
 - Materials degradation
 - Metal release (Pb, Cu, etc.)
- **Non-uniform corrosion**
 - Pinhole leaks (copper)
 - Dezincification
 - Tuberculation (iron, galvanized steel, brass)
- **Galvanic**
 - Soldered joints
 - Brass devices
 - Coupling of different pipe materials





Factors Governing Lead Levels

- Sampling protocol
- Intrinsic Pb solubility of surface material (water chemistry)
- Rate of dissolution in short stagnation times
 - Galvanic driving force (different metals, brass, solder)
 - Diffusion from surface (reaches steady state)
- Length of contact with lead source
- Nature of lead release
 - Particulate
 - Soluble

Additional point: There are no “corrosion indices” or surrogate pipe rigs that can take the place of directly monitoring lead release.

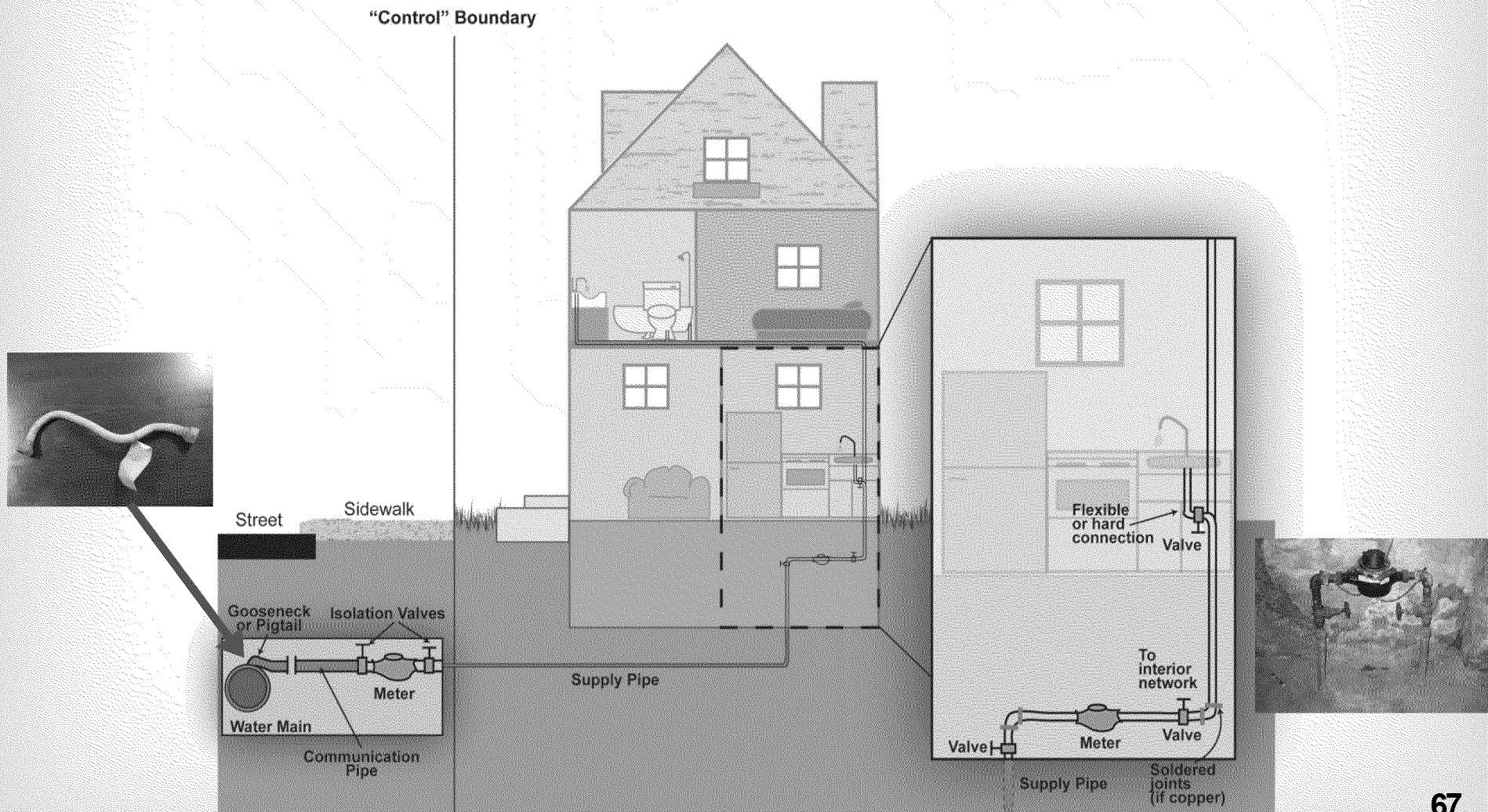


Many Places to Find Lead in Household Plumbing





Typical Household Pb Sources





“Ownership/Control” Situation 1

Scenario 1:

Only the portion of the service line from the water main to the external shut-off valve or property line is made of lead.

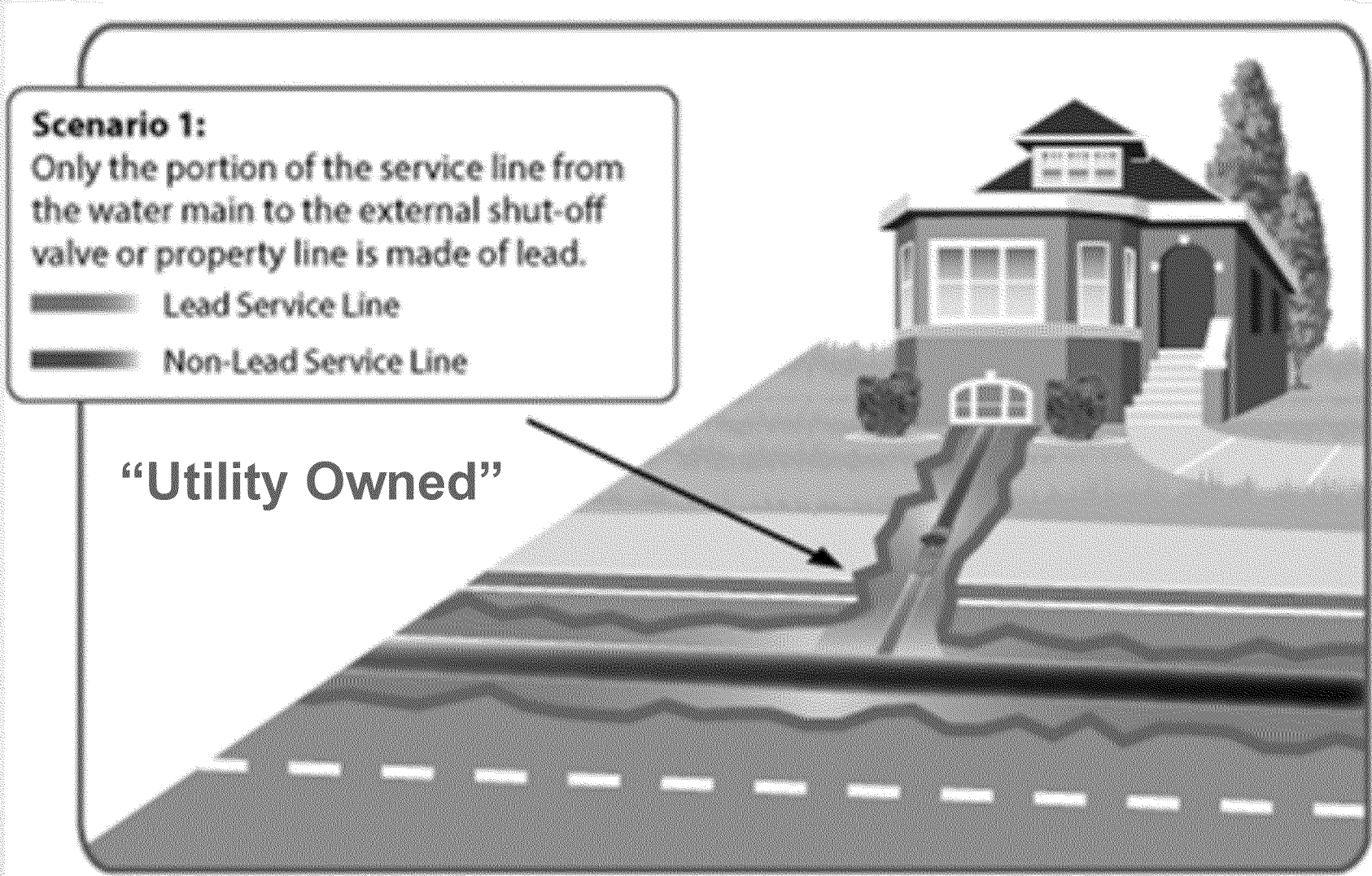
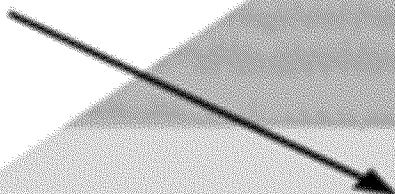


Lead Service Line



Non-Lead Service Line

“Utility Owned”





“Ownership/Control” Situation 2

Scenario 2:

Only the portion of the service line from the external shut-off valve or property line to the interior plumbing is made of lead.



Lead Service Line



Non-Lead Service Line

“Property Owner
Owned”





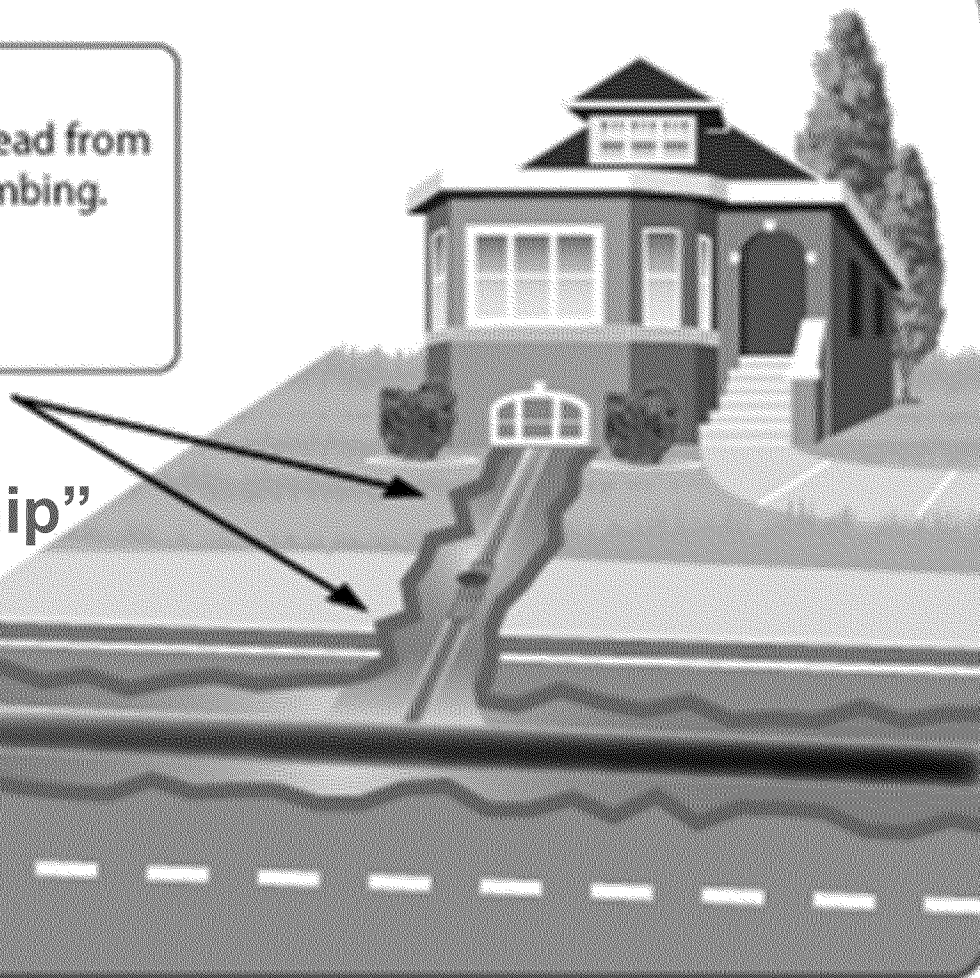
“Ownership/Control” Situation 3

Scenario 3:

The entire service line is made of lead from the water main to the interior plumbing.

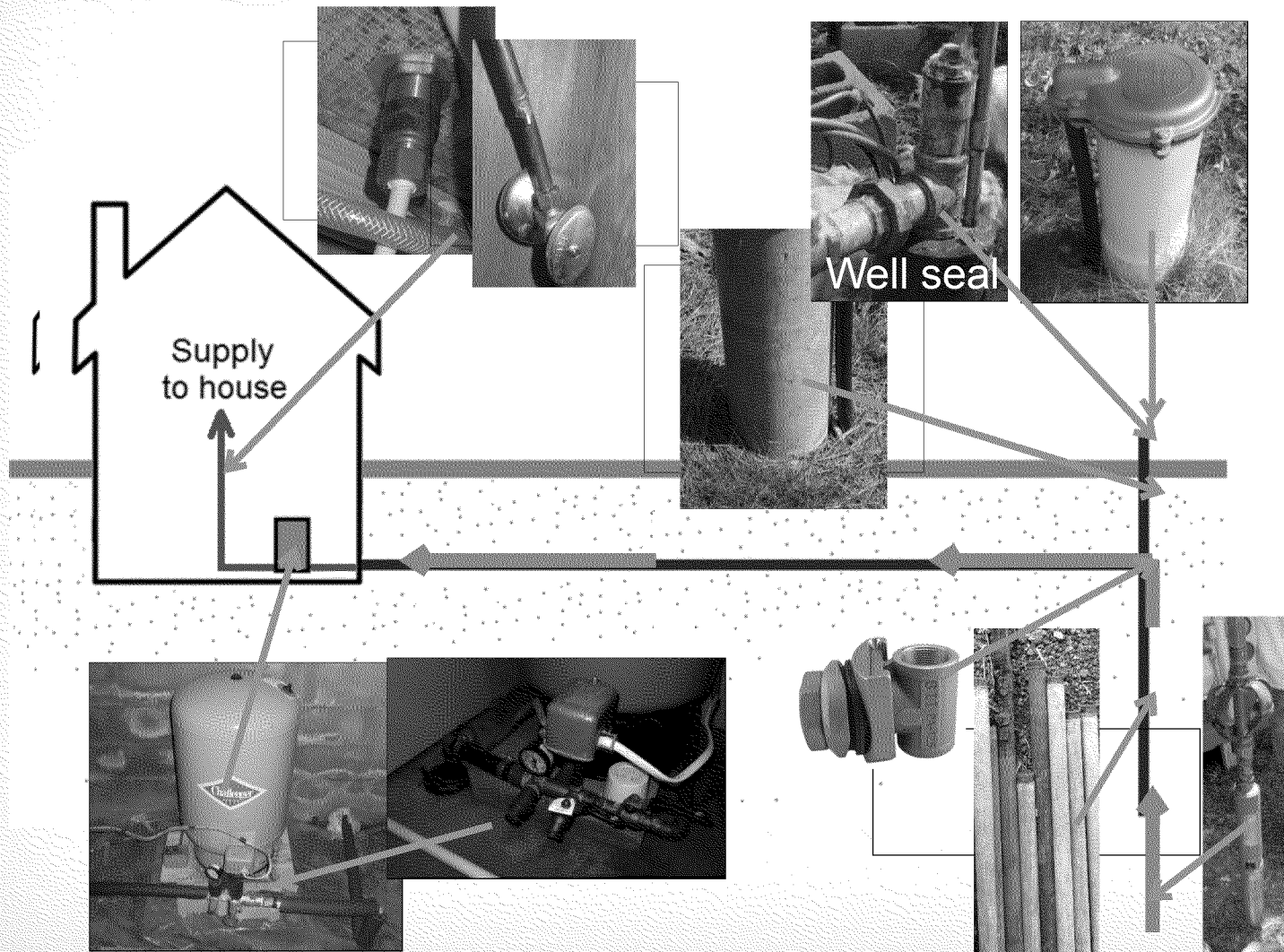
Lead Service Line

“Mixed Ownership”
= Shared
Responsibility





Private Water System Pb Sources

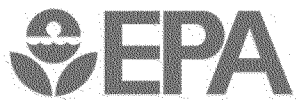


Courtesy: Kelsey Pieper, UNC



Main Connection through Curb Stop





Two Problems at Once: Galvanic Corrosion and LSL Disturbance!!

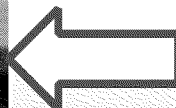




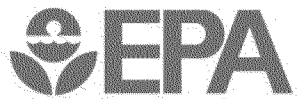
Examples of Service Line Replacement



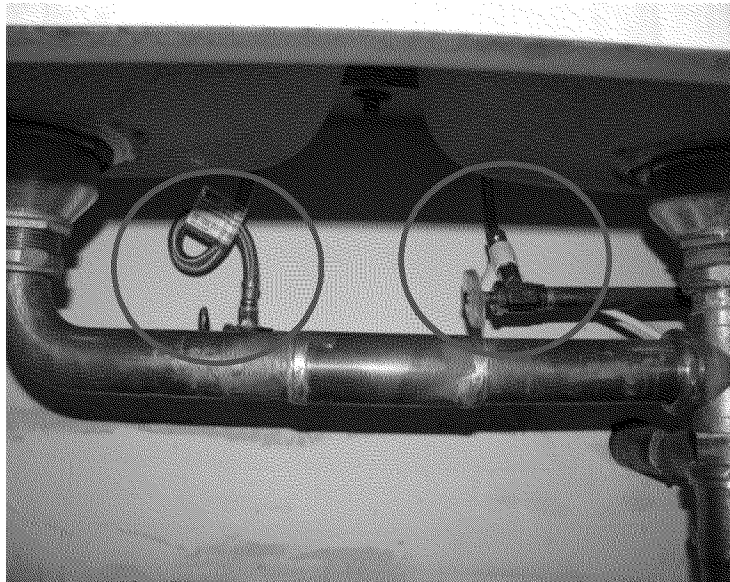
Copper replacing steel



Lead (before replacement)



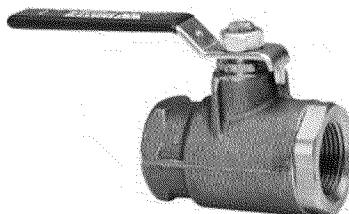
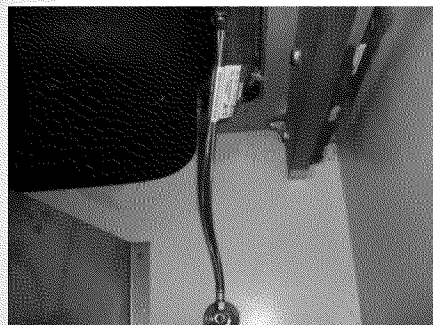
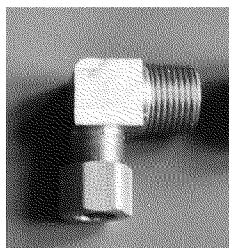
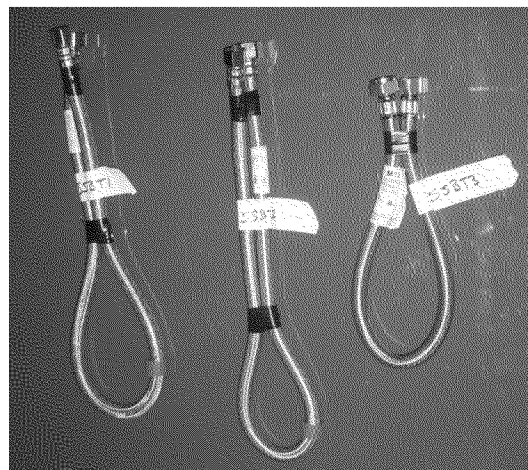
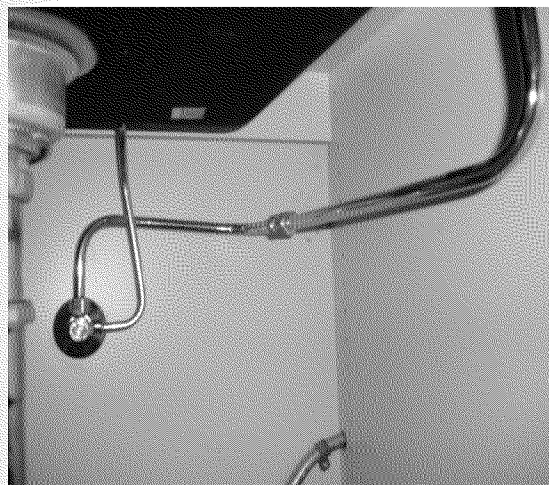
Valves Often Are Overlooked When Focus is on Faucets



- Shut-off valves frequently captured in 250 mL to 1 L samples
- Often not certified ANSI/NSF Section 9



Lead Sources Are Often Hidden





Characteristics of Pb Sources

- When present, LSL is biggest reservoir of Pb, but may not always be highest spike or peak value
 - Dislodged particles
 - PbO₂-LSL scale systems may have higher Pb from brass fixtures and fittings
- Pb sources within housing and buildings
 - Numerous hidden locations (behind walls, under floors, etc.)
 - Small lateral extent in each occurrence
 - May be located considerably distance from consumption tap
- Sampling instruction details matter
 - Random use pattern presumed by LCR
 - Pre-flushing all but eliminates detecting LSL contribution
 - Water use *prohibited from tap* is different from
 - Water use *prohibited from house/feed line*



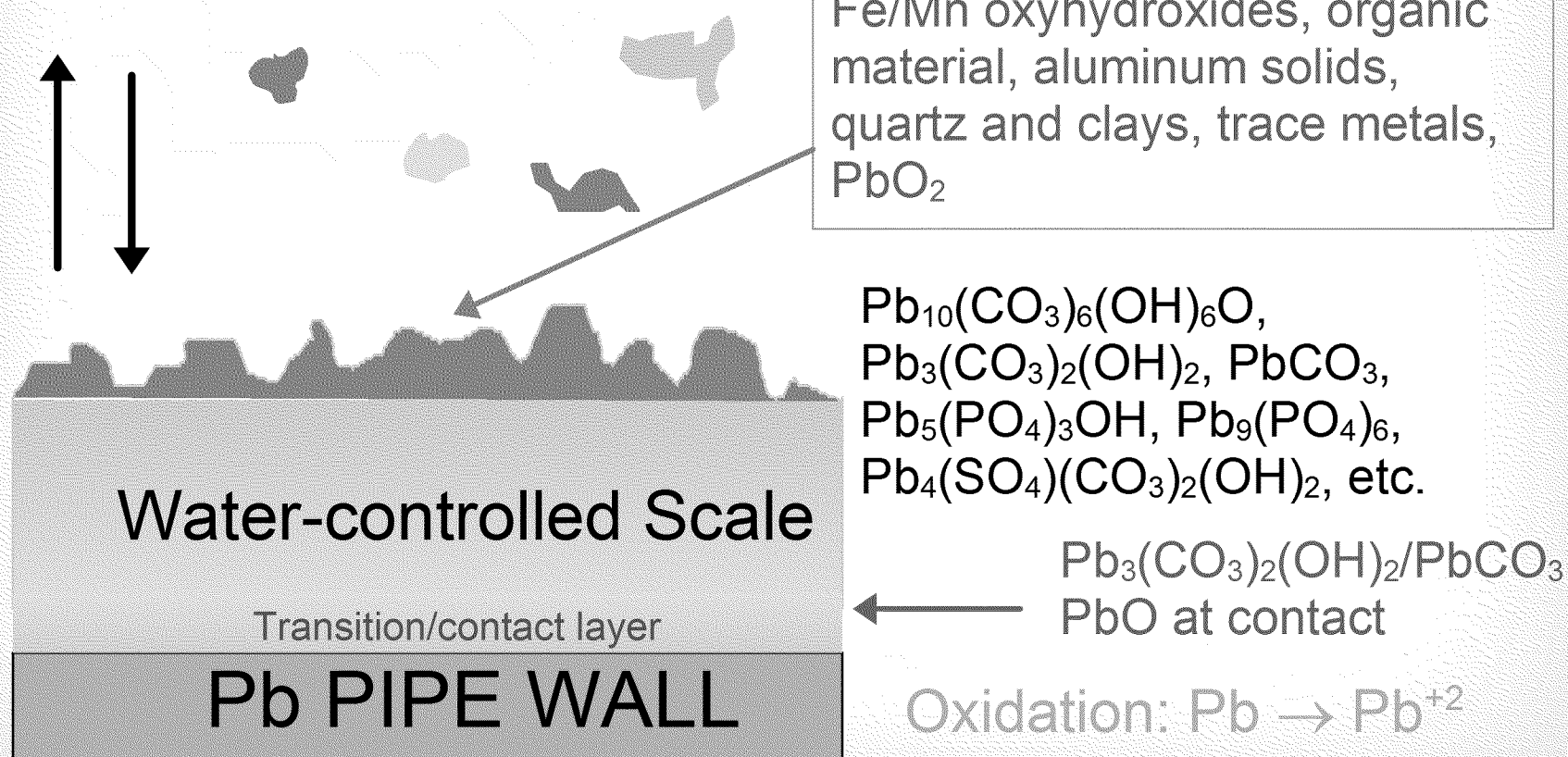
Accidental or Intentional Treatment to Immobilize Lead Release





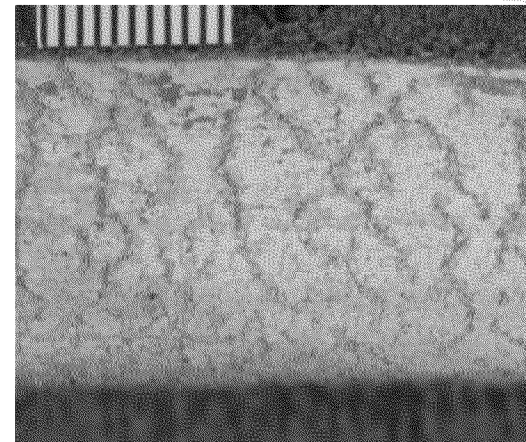
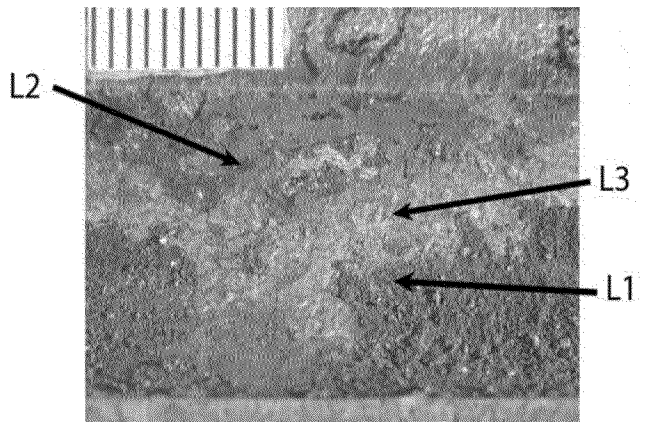
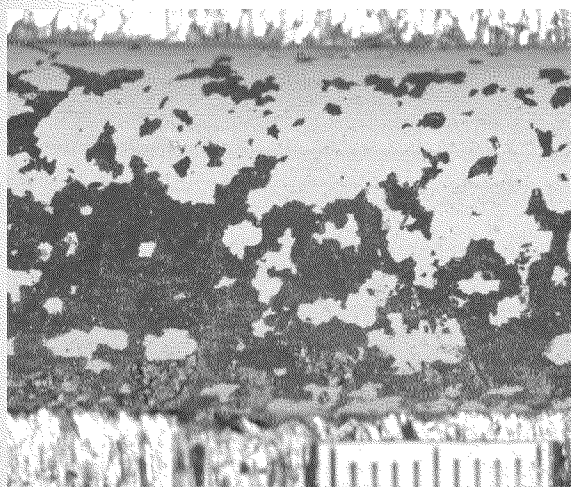
Typical Pb(II) Scale X-section

Soluble Metal (Exaggerated vertical scale!)





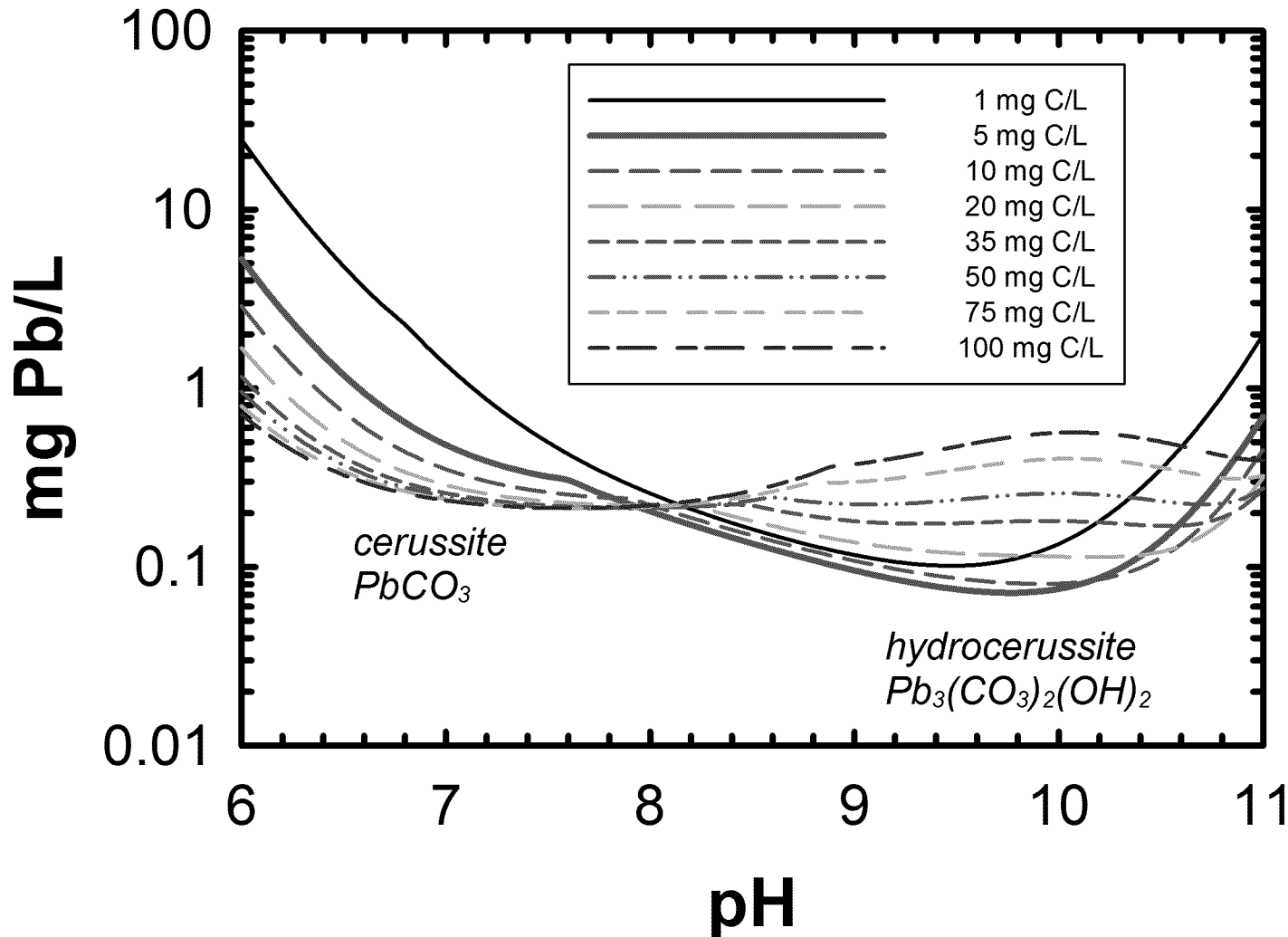
Only some LSL scales are simple

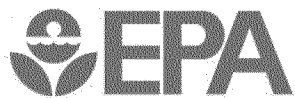




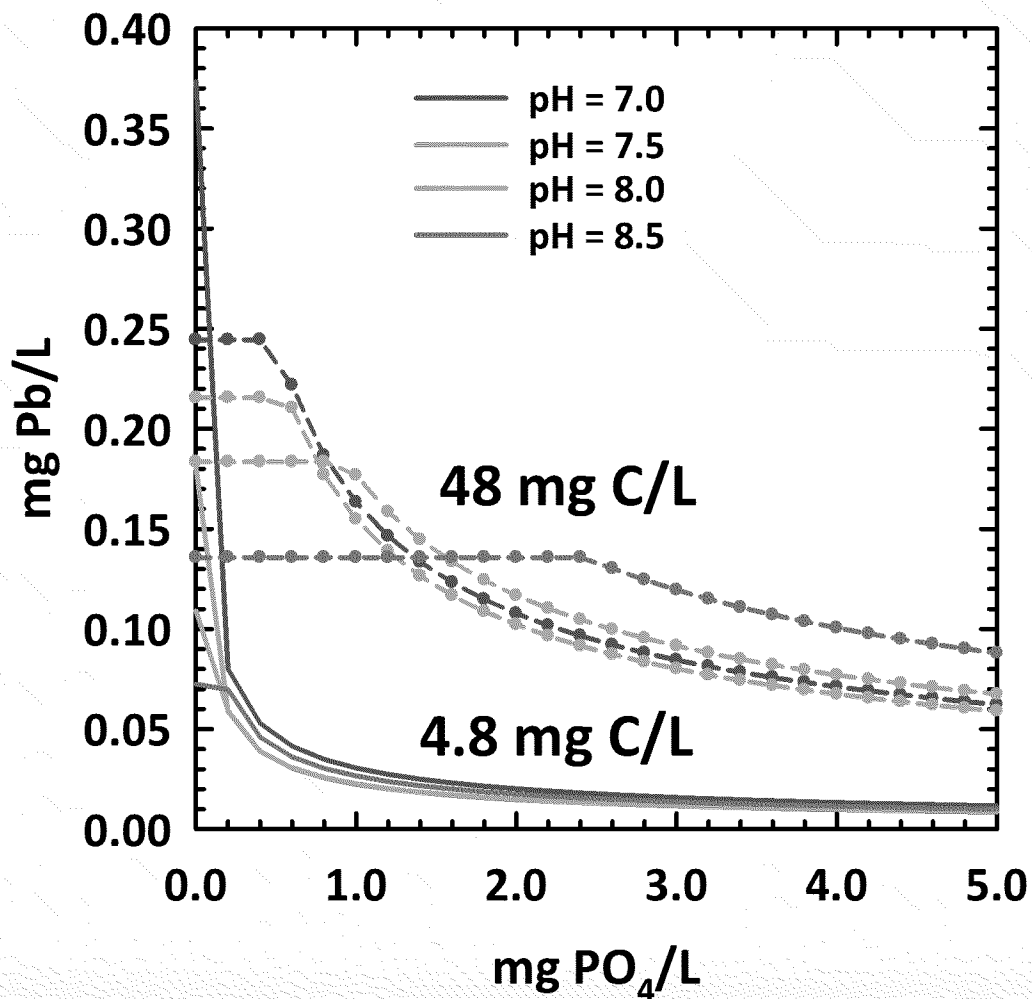
Effect of DIC and pH on Pb(II) Soly.

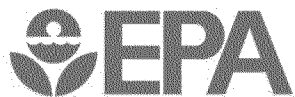
$$\text{DIC} = [\text{H}_2\text{CO}_3^*] + [\text{HCO}_3^-] + [\text{CO}_3^{2-}]$$



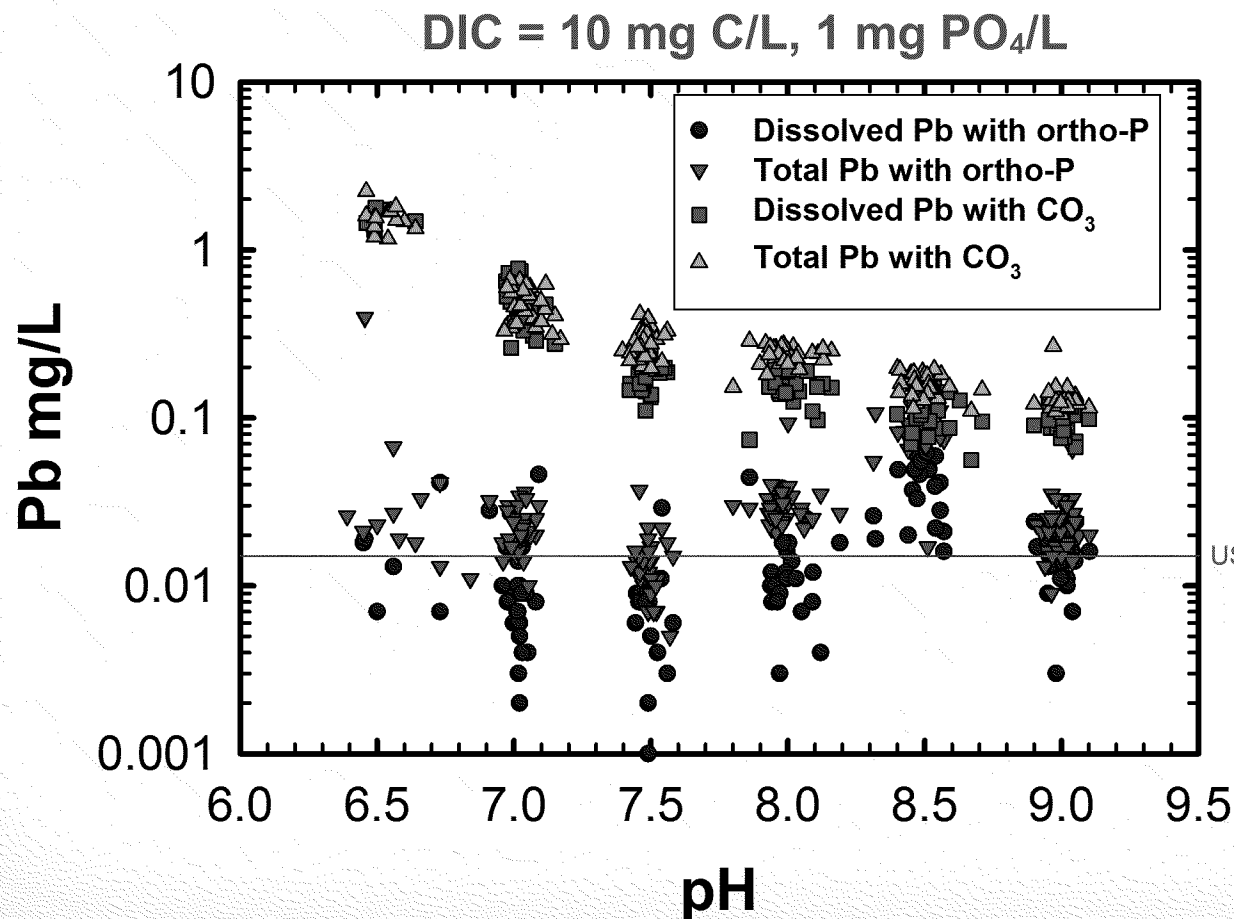


Pb(II) Solubility is Reduced by Orthophosphate (also with soils)





Effect of pH and PO_4 on Pb Release



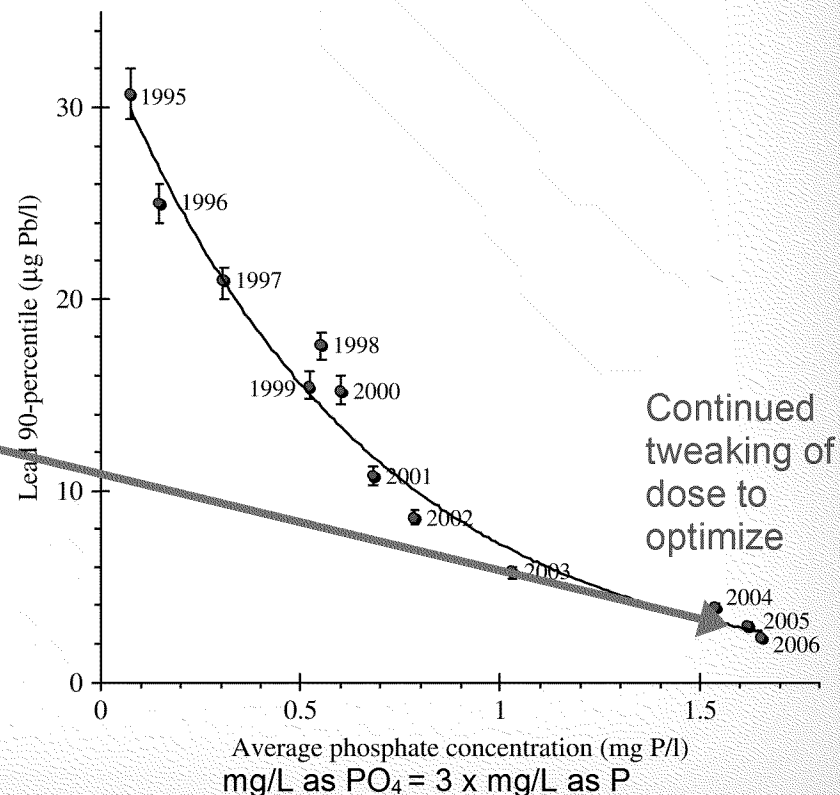
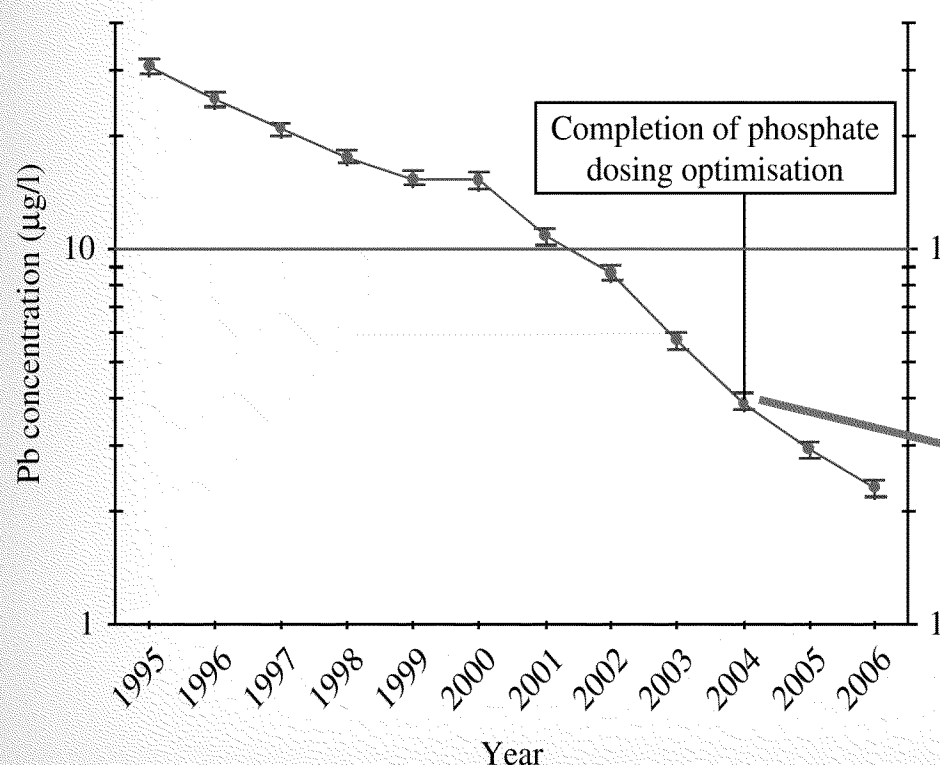
At low DIC,
orthophosphate
improves lead
release
regardless of
pH

Schock, M. R.; DeSantis, M. K.; Metz, D. H.; Welch, M. M.; Hyland, R. N.; Nadagouda, M. N. *Revisiting the pH Effect on the Orthophosphate Control of Plumbosolvency*, Proc. AWWA Annual Conference and Exposition, Atlanta, GA, **2008**.



Treatment Works on Both Soluble & Particulate Release

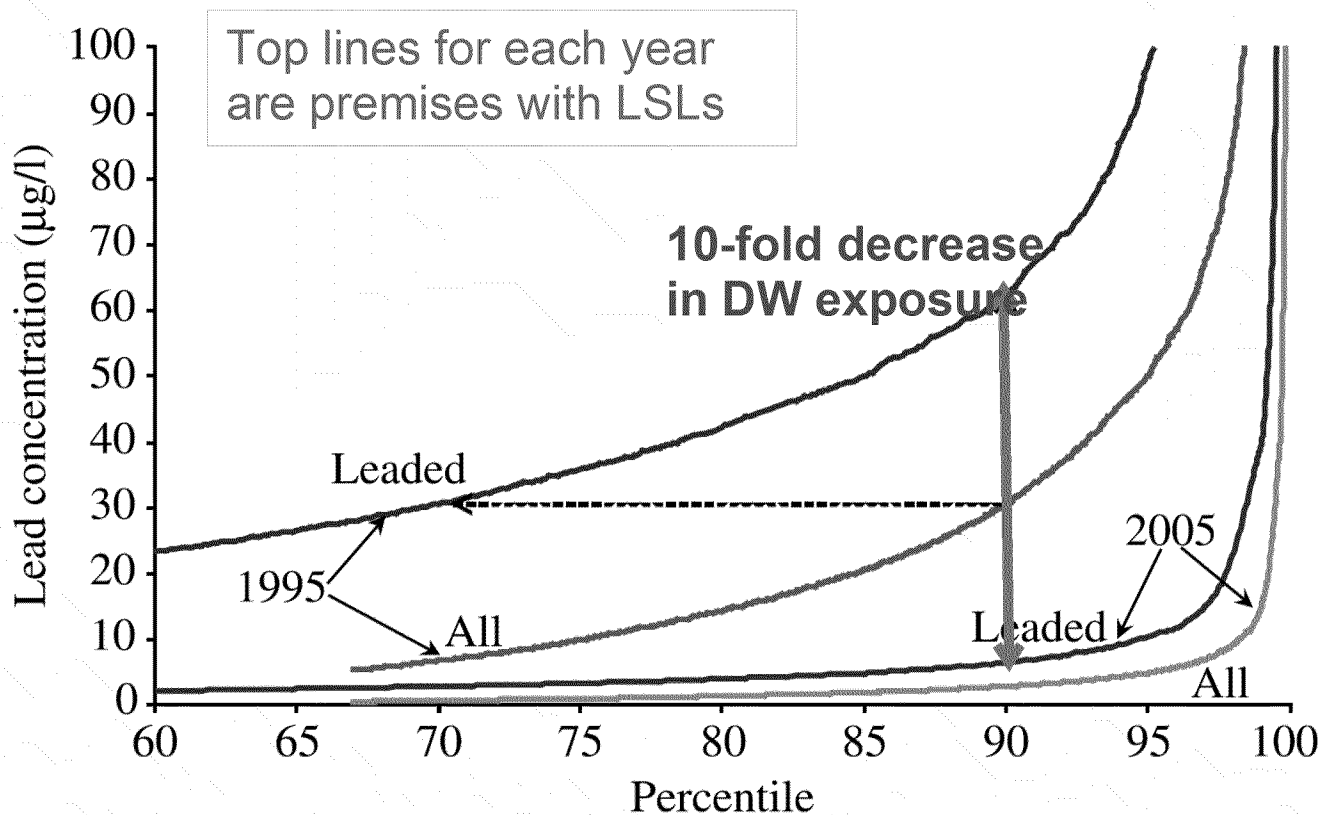
Aggregated UK Monitoring Data: Used two-pronged approach:
(1) Initial dose estimation by pipe rig study for background water
(2) RDT tap monitoring to assess progress & exposure



Cardew, P. T. Measuring the benefit of orthophosphate treatment on lead in drinking water. *J Water Health* 2009, 7 (1), 123-31.



UK Decade of Pb Optimization Progress for Both LSLs and Other Pb Sources



Cardew, P. T. Measuring the benefit of orthophosphate treatment on lead in drinking water. *J Water Health* **2009**, 7 (1), 123-31.



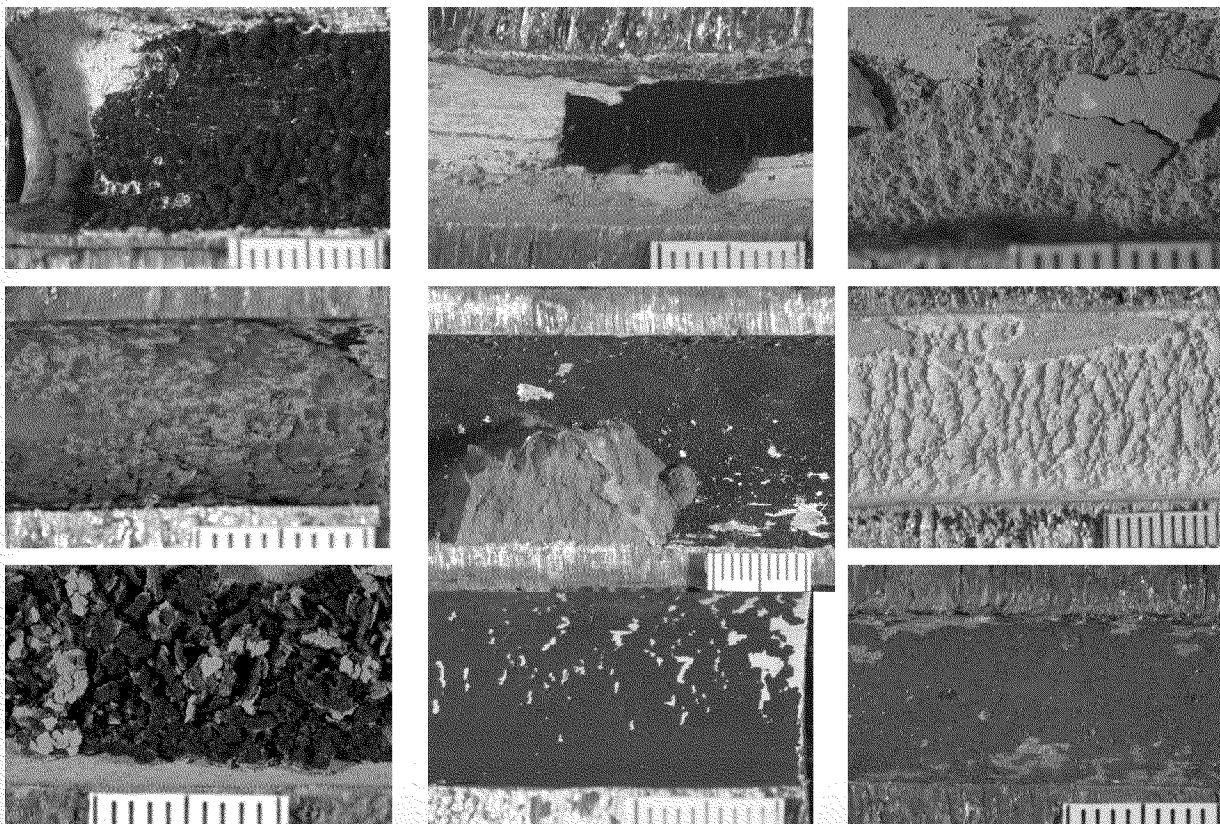
There Are Many Types of Scale on Pb Pipe

- Simple carbonate or hydroxycarbonate Pb(II) mineral
- Simple Pb(II) orthophosphate mineral
- Simple PbO₂ solid phase, by itself or mixed with Pb(II) phases
- Mix of Pb(II) phases
- Protective “diffusion barrier” materials
 - Could be insoluble amorphous Pb(II) phase
 - Adherent non-Pb phase
- Surface fouling deposit
 - Primarily not made of lead, usually not crystalline
 - Lead may sorb to surface
 - Often not adherent



Many LSL Scales Are Mixtures of Solids

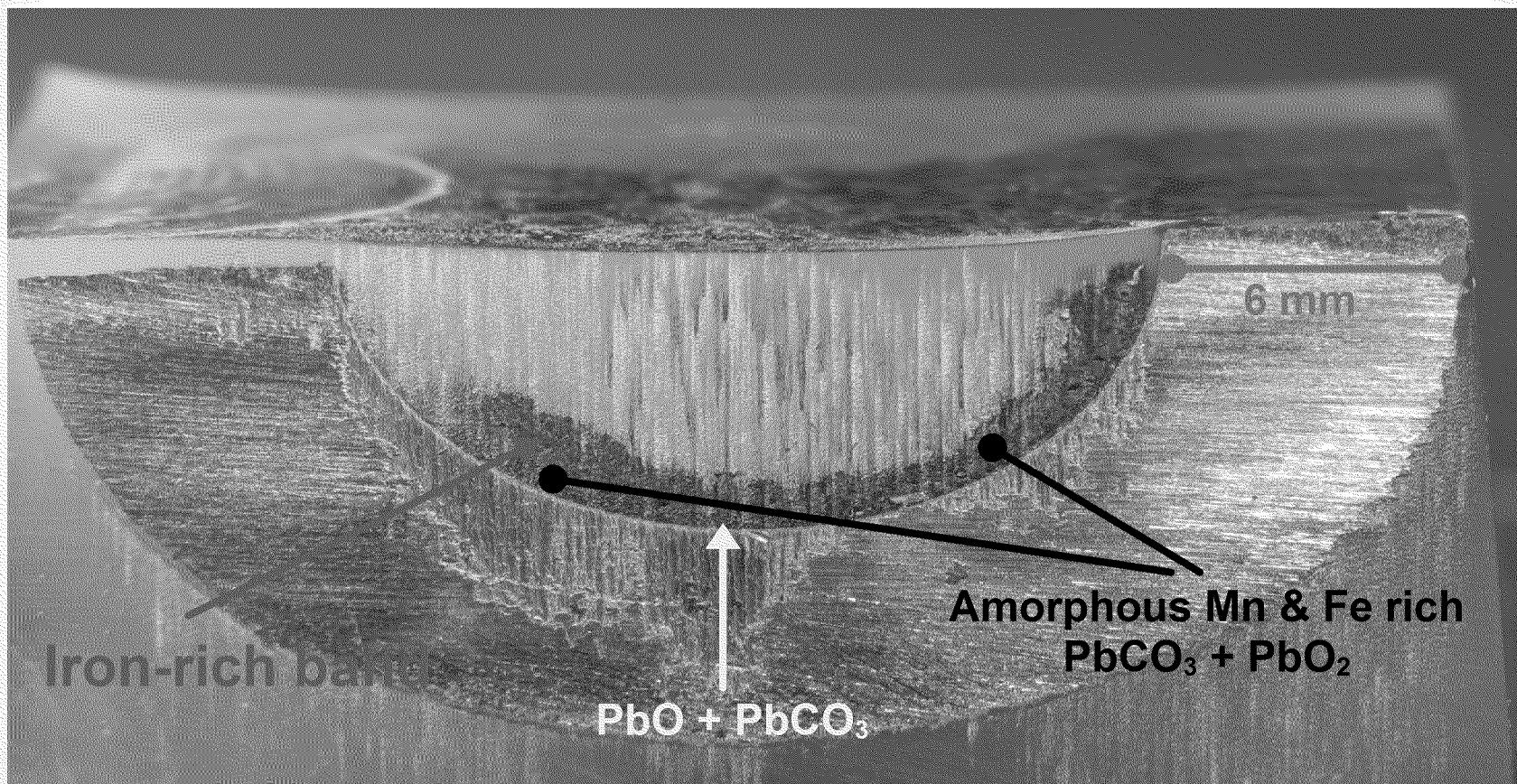
18 of 52 DWDS studied by EPA show external layer deposits almost completely made of poorly crystalline Mn, Fe, Al, Ca, or Si-rich phases



Adding orthophosphate or just adjusting pH with thick coatings likely will not minimize lead release until causes of the interfering buildups are controlled

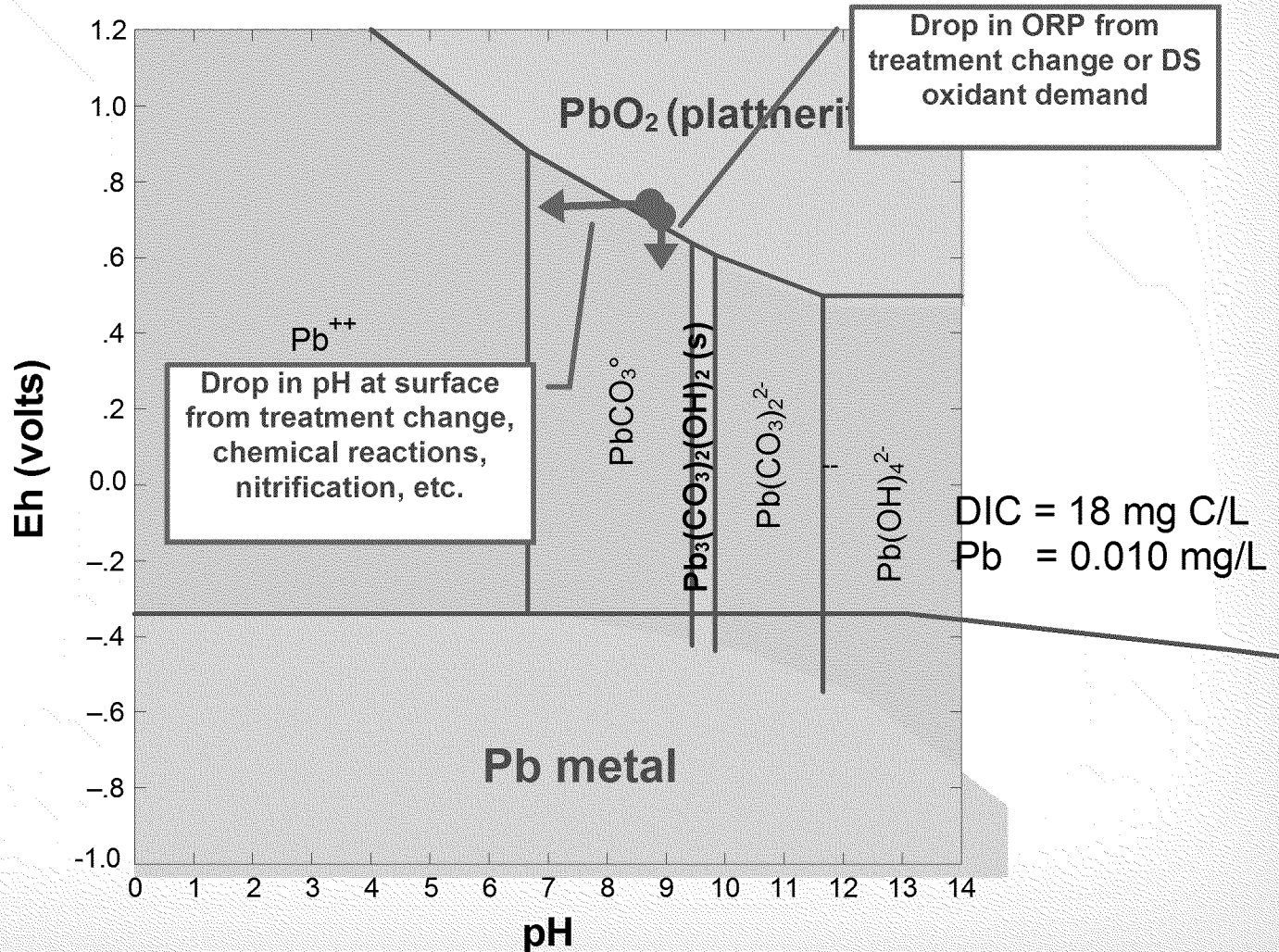


Layering from ORP-Induced Deposition





Protective PbO_2 May Form at High ORP



Disinfectant demand in DS must be controlled and enough free chlorine consistently maintained throughout LSL area

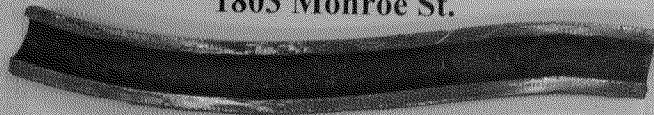


Examples of Protective PbO_2 Scales

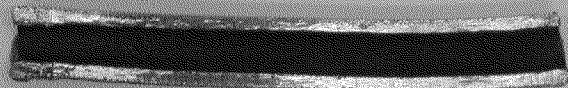
WASHINGTON, DC
Lead Service Line (c. 1926/8-2004)



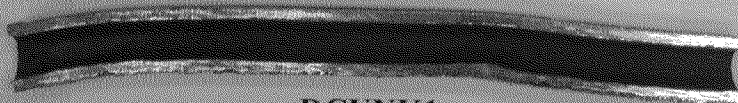
1803 Monroe St.



1335 Hemlock St. NW

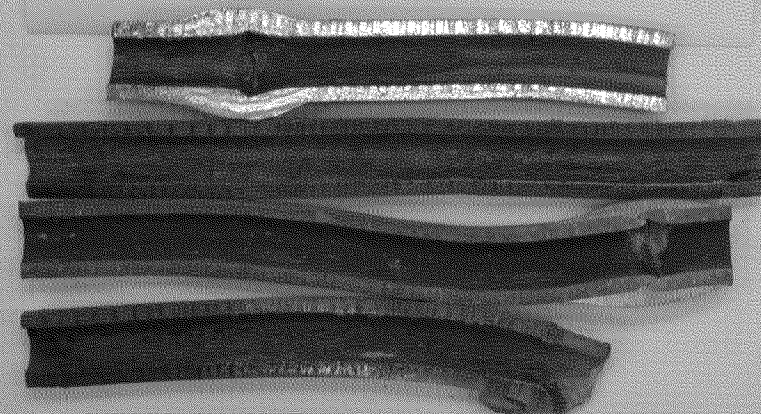


1340 Hemlock St. NW



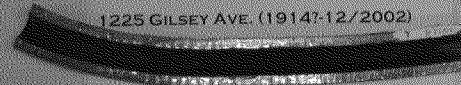
DCUNK1

Oakwood, Ohio
Lead Service Lines (rem. 2002)



CINCINNATI, OH
LEAD SERVICE LINE

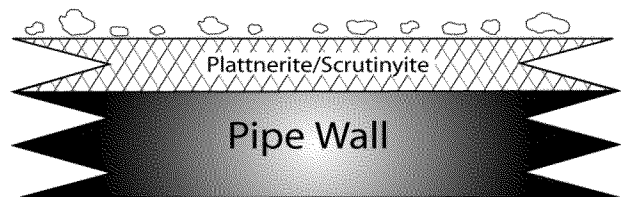
1225 GILSEY AVE. (19147-12/2002)



119 CATALPA RD. (19257-1/24/03)

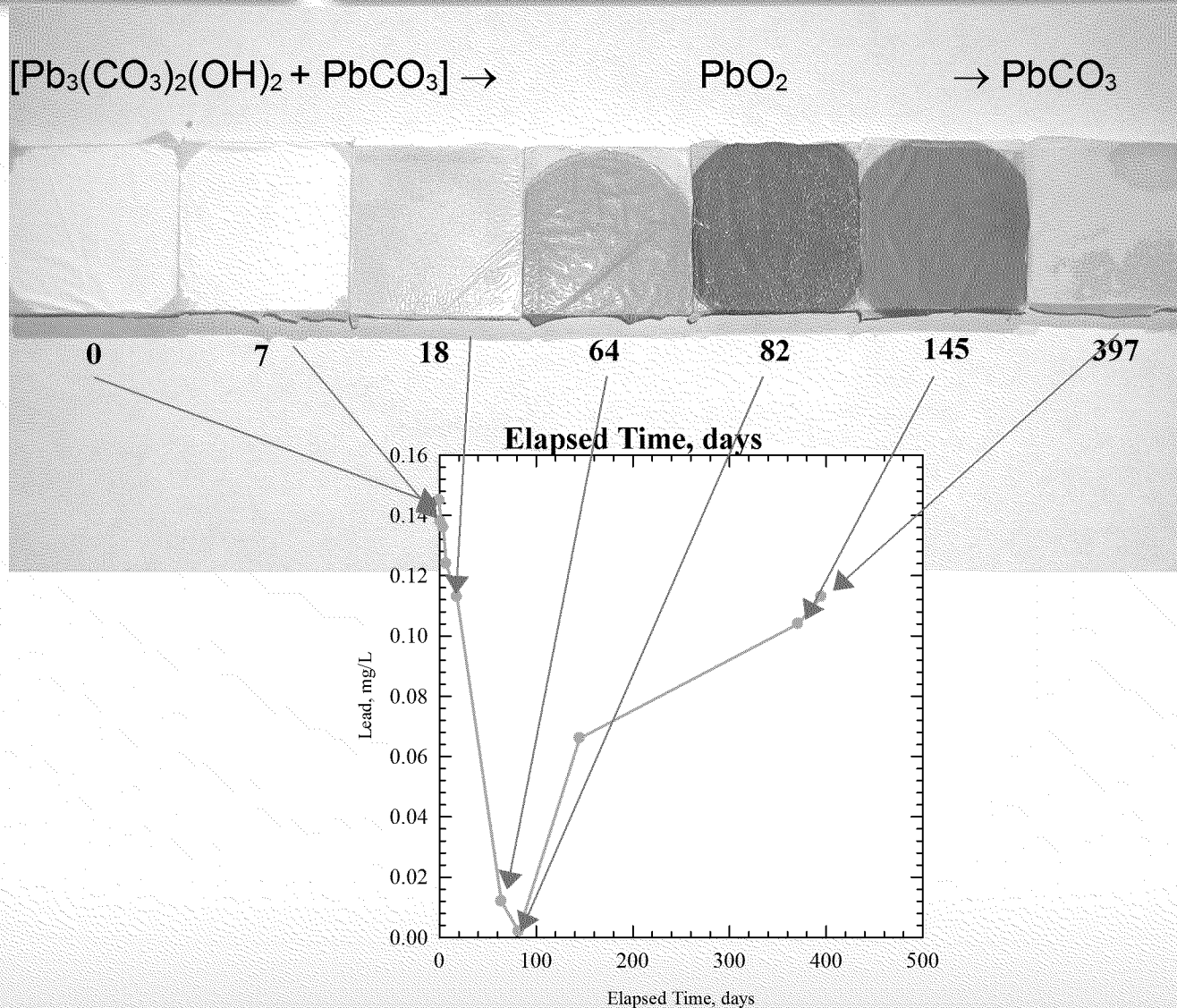


3030 JUNIETTA AVE. (19307-1/24/03)



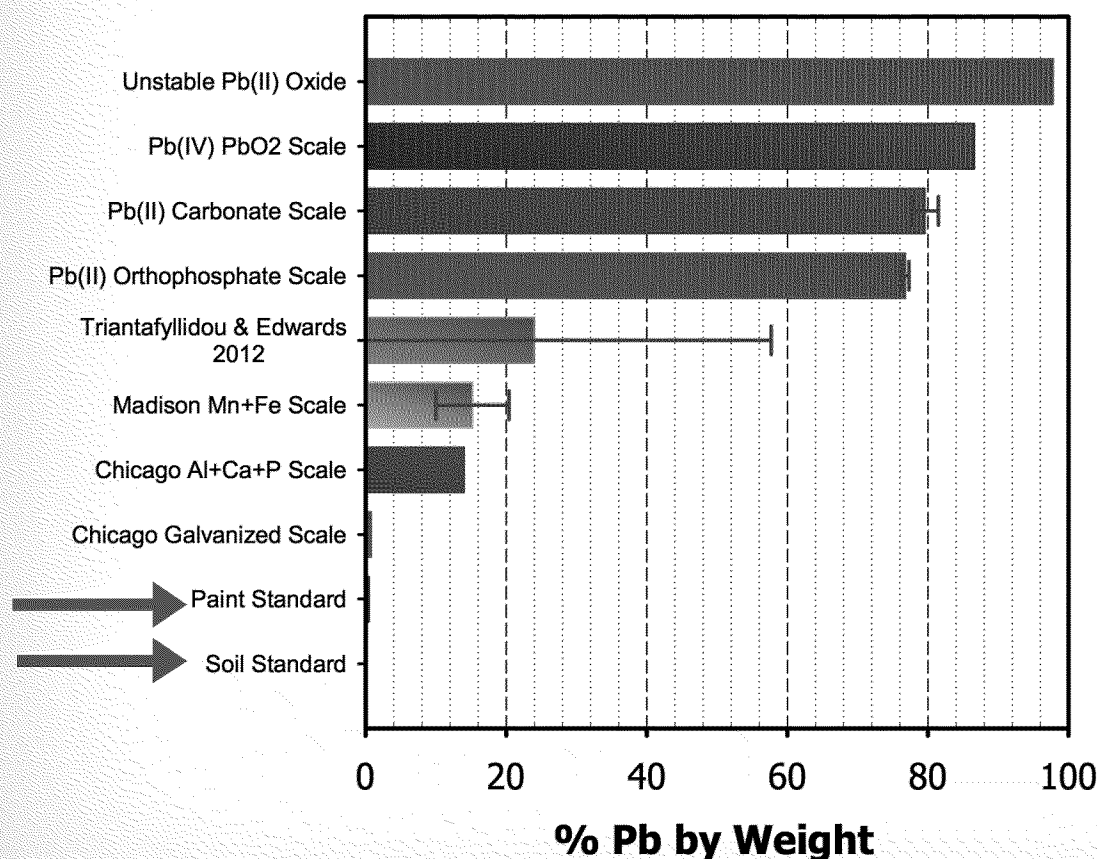


PbO₂ Scales Can Deteriorate if ORP Drops





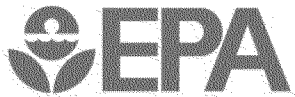
Drinking through Lead-Painted Pipes



Pipe scale particles have as much or more lead than Pb in paint or soil and is absorbed into food and concentrated, as well as directly ingested from water or beverages

Erosion and suspension of particles from pipe corrosion scales and deposits is inevitable.

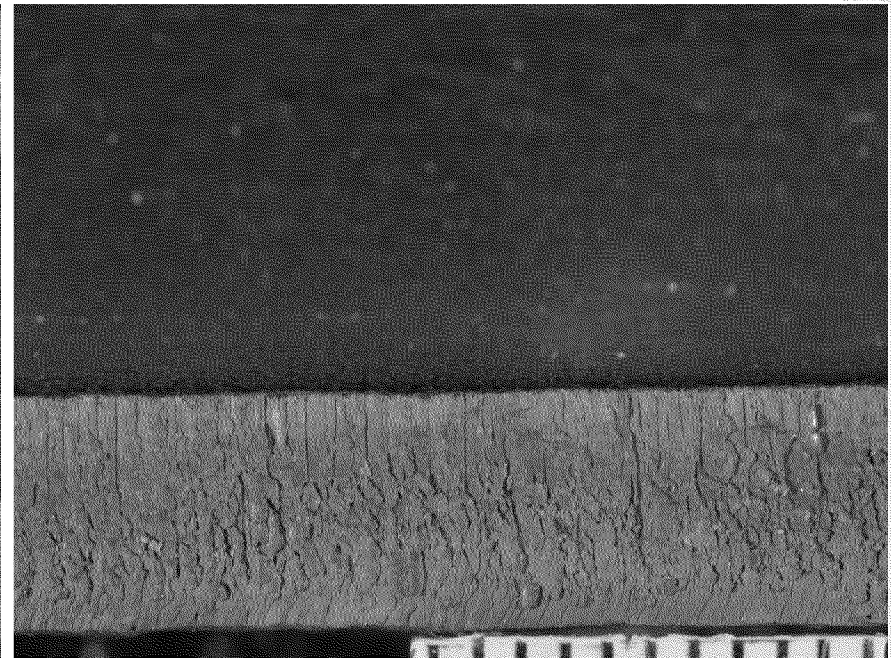
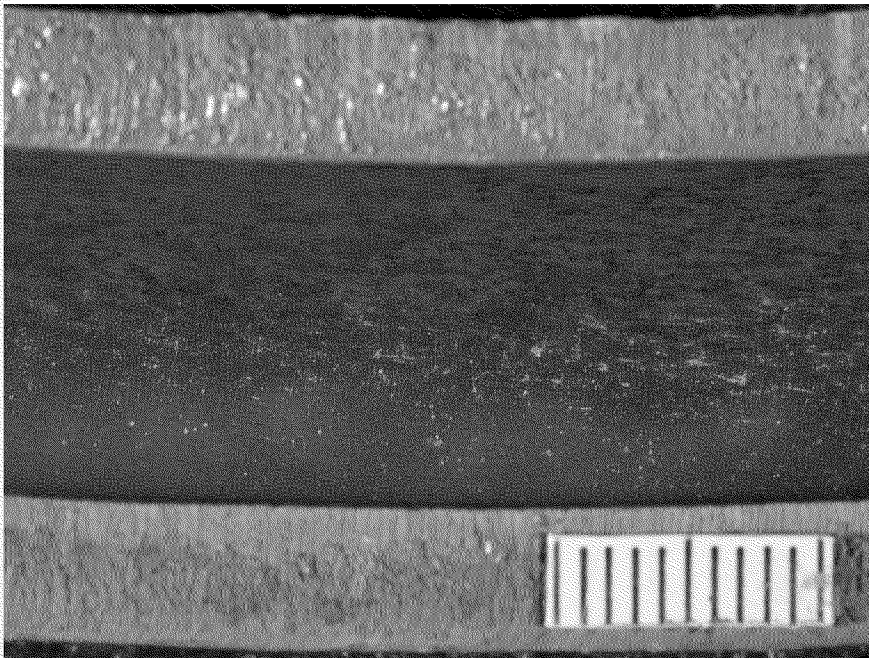
Even minute amounts are greater relative exposure than paint or soils



Lead Pipes Are Forever.... (Need to Be Removed)

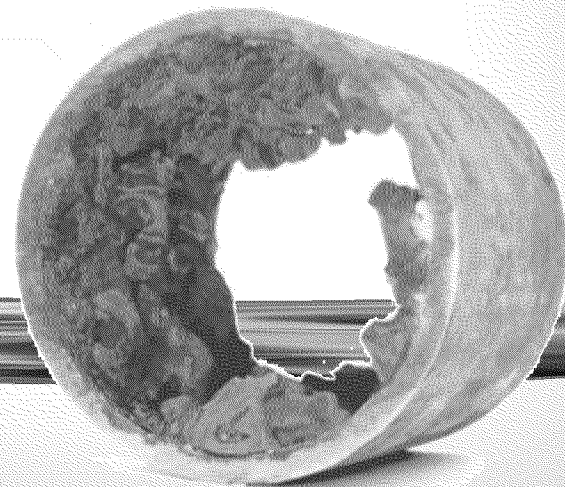
Lead Pipes Won't Go Away Any Time Soon

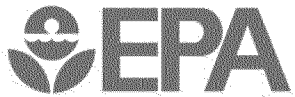
Installed Right After the Civil War 150 Years Old in Cincinnati: Any Signs of Failure?





The “Lead and Copper Rule” (LCR)





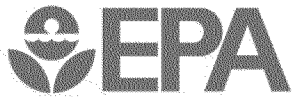
LCR Basic Framework: PWS ONLY

- 90th percentile Action Level IS NOT A HEALTH-BASED NUMBER
- Number is based on 1990 state of the art estimate of treatment “feasibility,” adjusted for system size
- Large systems required to “*minimize*,” not just meet AL
- AL triggers actions
 - More monitoring
 - Public Education
 - Treatment studies/implementation if not already doing so
 - Utility-owned lead service line replacement
- No violations attached to high Pb levels
- Violation/compliance mechanism is only monitoring and maintenance of “Optimal Water Quality Parameters”



Problems with OWQPs

- They were never set for most systems
- They are not a precise surrogate for lead release
 - Many interacting chemical & physical variables
 - Large fraction of systems aren't protected by simple Pb mineral scales
 - No theoretical basis for defining or setting parameters when scales are amorphous material of indefinite composition
- States set meaningless ranges that may not relate to Pb release
 - DC: phosphate range: 0.5-5 mg/L, pH over 7.2 in system
 - Houston: pH 7.6-8.6; alkalinity "over 20)

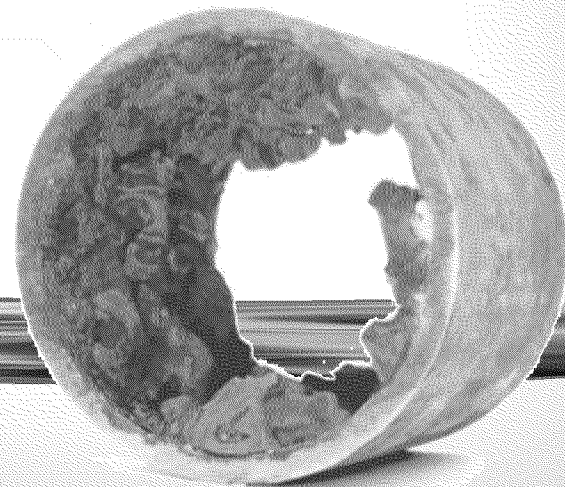


Sampling that Misses LSL Release

- Full preflushing before stagnation period
 - NOT intended by LCR, which relies upon random starting point across a community to be sure that LSC contributions in corrosive waters are captured in 1st draw, 1st liter
 - Some systems have LSLs but plastic interior pipes, particularly misleading when coupled with pre-flush
 - Recall that LCR sample typically represents first 10-20 ft behind tap
- Suggest samples be taken as close as possible to 6 hours stagnation
- Select high water use sites
- Avoid sampling from areas of DS where repair/rehabilitation is being done
- Select sampling sites from least corrosive water when DS is fed by multiple water qualities
- Do not check/verify proper age or type of site (LSL, Pb:Sn solder)



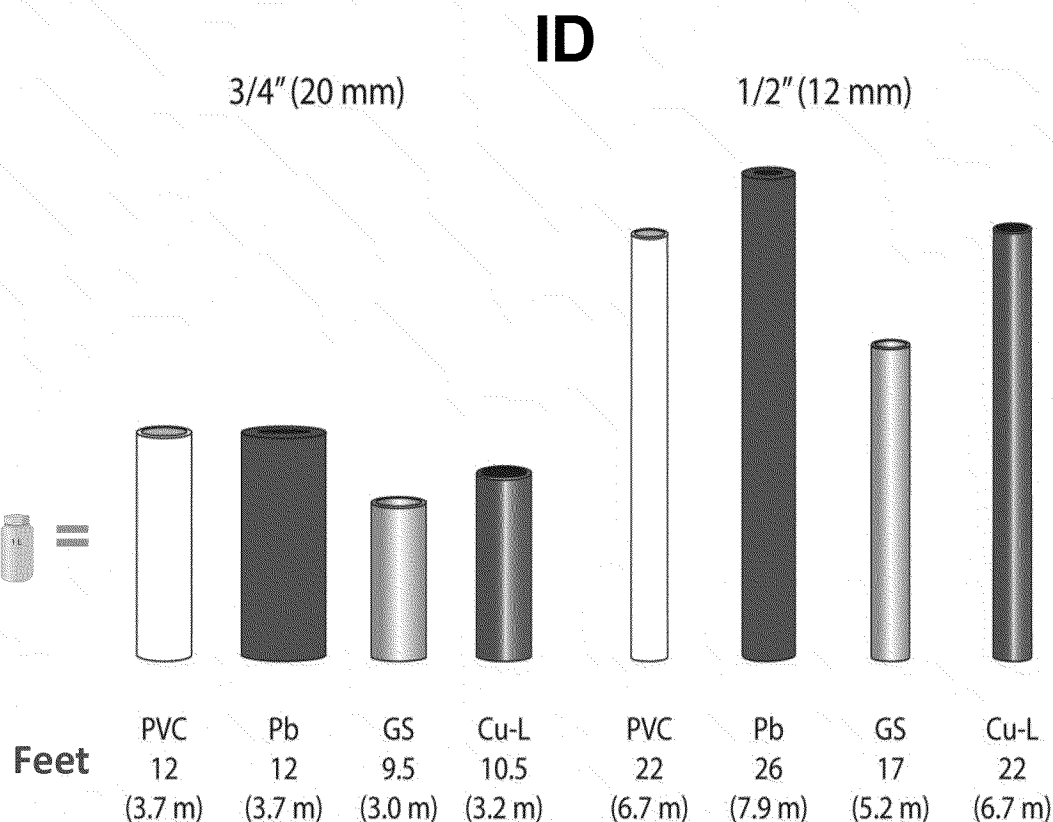
SAMPLING to Identify Lead Sources





Tool: Sample Volumes Represent Source Position in Plumbing

Wide-mouth bottles preferable to allow higher flow rate

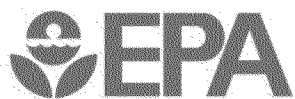


After: Schock, M. R.; Lytle, D. A. Internal Corrosion and Deposition Control; In *Water Quality and Treatment: A Handbook of Community Water Supplies*; Sixth ed. 2011.



Sample Volume Per Length: Cu

Material	Type	Nominal Size (in)	OD (in)	Thickness (in)	ID (in)	mL/ft	mL/m	ft per L	m per L
Copper tube	K	0.500	0.625	0.049	0.527	43	141	23.3	7.1
Copper tube	L	0.500	0.625	0.04	0.545	46	151	21.8	6.6
Copper tube	M	0.500	0.625	0.028	0.569	50	164	20.0	6.1
Copper tube	K	0.750	0.875	0.065	0.745	86	281	11.7	3.6
Copper tube	L	0.750	0.875	0.045	0.785	95	312	10.5	3.2
Copper tube	M	0.750	0.875	0.032	0.811	102	333	9.8	3.0
Copper tube	K	1.000	1.125	0.065	0.995	153	502	6.5	2.0
Copper tube	L	1.000	1.125	0.05	1.025	162	532	6.2	1.9
Copper tube	M	1.000	1.125	0.035	1.055	172	564	5.8	1.8

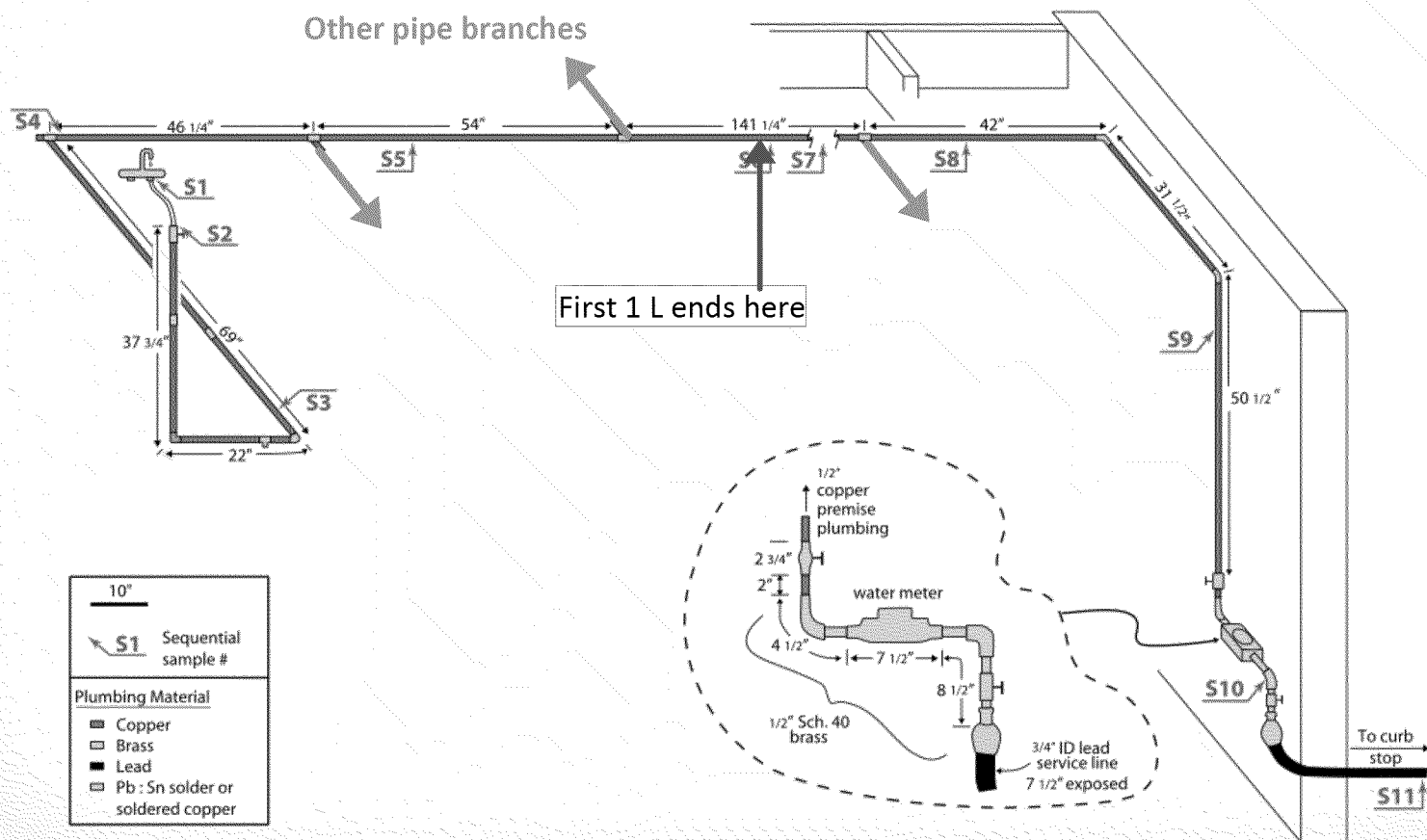


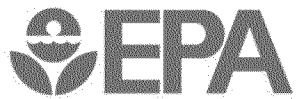
Sample Volume/Length (other)

Material	Type	Nominal Size (in)	OD (in)	Thickness (in)	ID (in)	mL/ft	mL/m	ft per L	m per L
Galvanized steel	Sched 40	0.500	0.840	0.109	0.622	60	196	16.7	5.1
Galvanized steel	Sched 40	0.750	1.050	0.113	0.824	105	344	9.5	2.9
Galvanized steel	Sched 40	1.000	1.315	0.133	1.049	170	558	5.9	1.8
Lead	0.25-in wall	0.500	1.000	0.25	0.500	39	127	25.9	7.9
Lead	0.25-in wall	0.625	1.125	0.25	0.625	60	198	16.6	5.1
Lead	0.25-in wall	0.750	1.250	0.25	0.750	87	285	11.5	3.5
PVC, CPVC	Sched 80	0.500	0.84	0.147	0.546	46	151	21.7	6.6
PVC, CPVC	Sched 80	0.75	1.05	0.154	0.742	85	279	11.8	3.6
PVC, CPVC	Sched 80	1	1.315	0.179	0.957	141	464	7.1	2.2
HDPE	200 psi	1	1.315	0.146	1.023	162	530	6.2	1.9

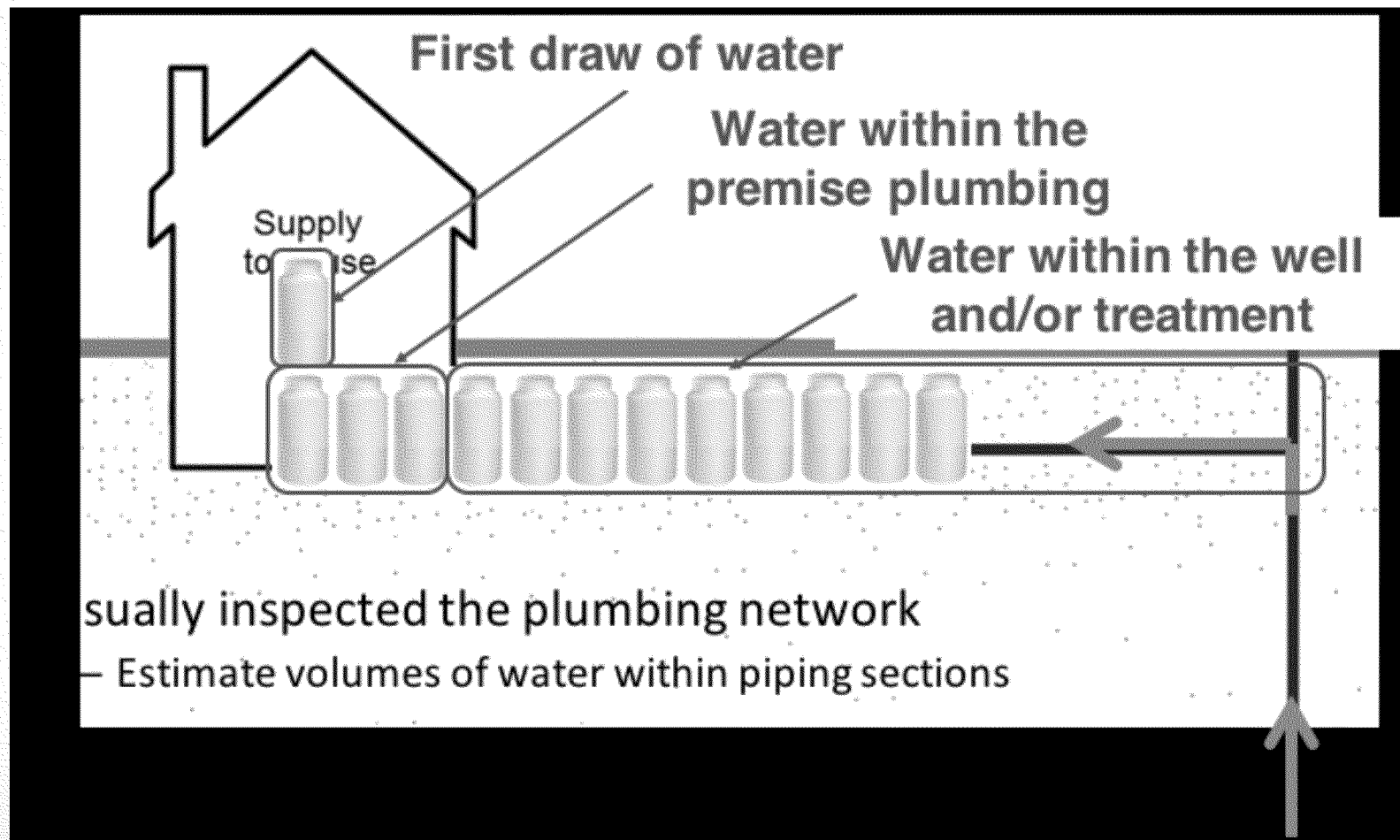


Identifying Pb Sources in a House: Volume as Distance





Concept of Sequential Sampling (aka “profiling”)

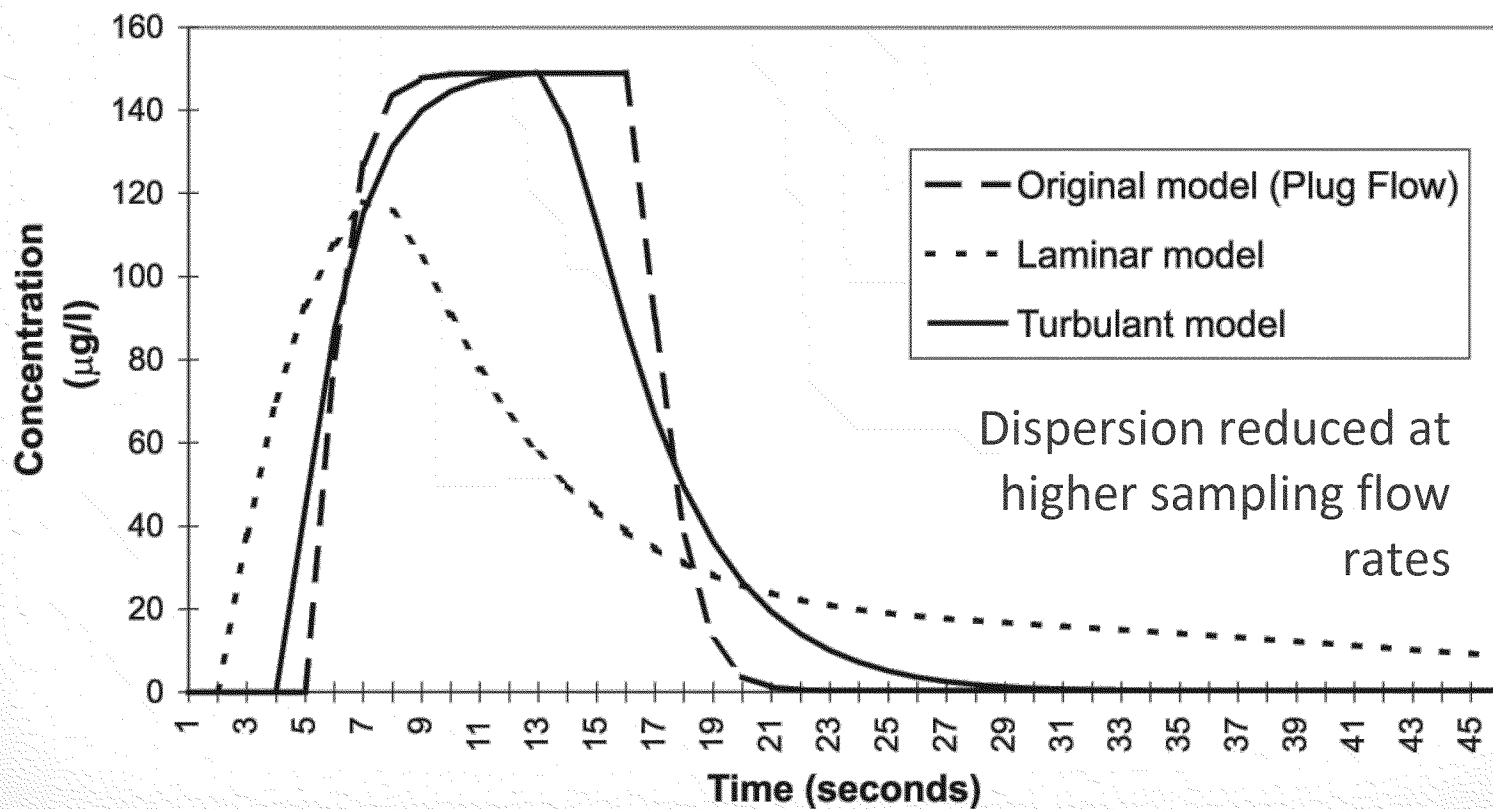


Courtesy: Kelsey Pieper, UNC

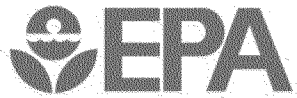


Resolution Depends on Dispersion

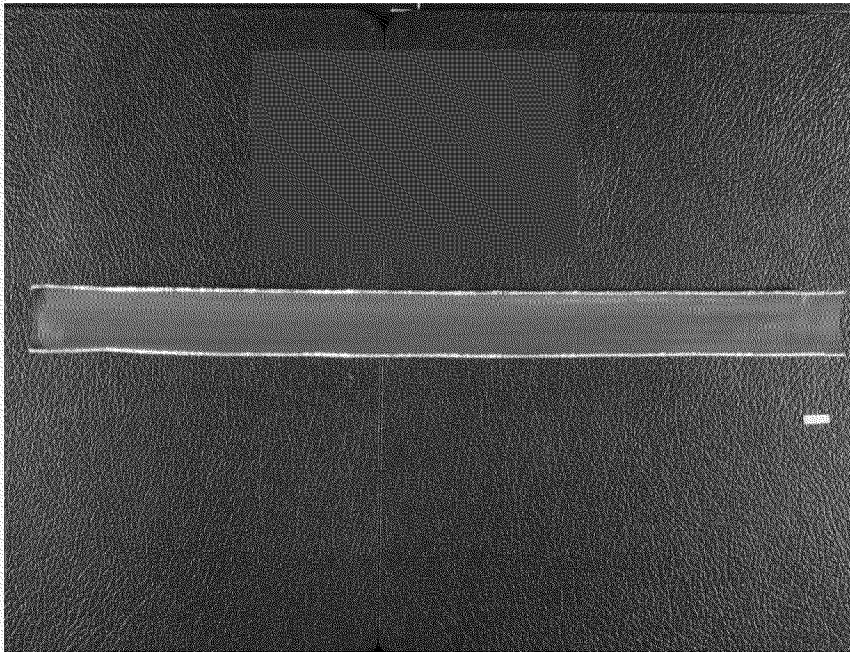
Average Concentration at Tap



From: VanDer Leer et. al. *Applied Mathematical Modelling*, (2002) 26:681–699



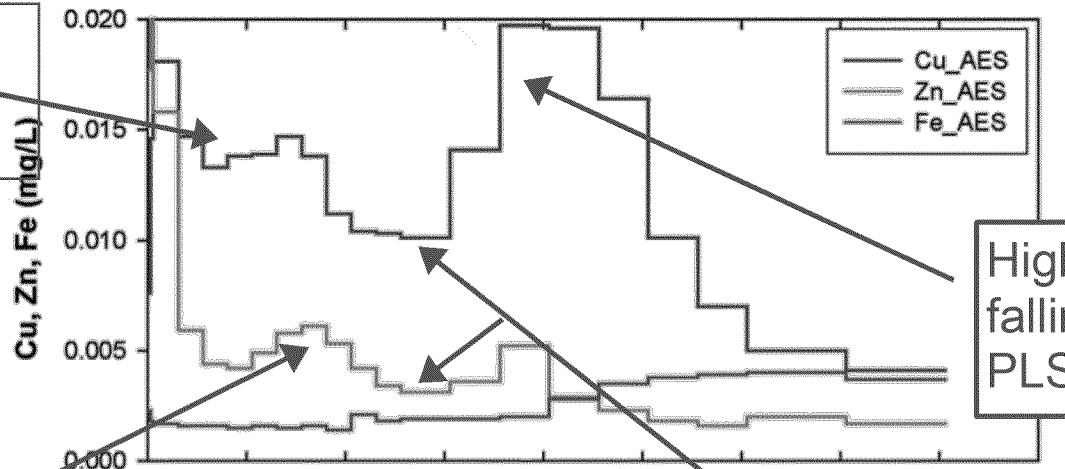
Tuberculation and Physical Characteristics Impact Fl





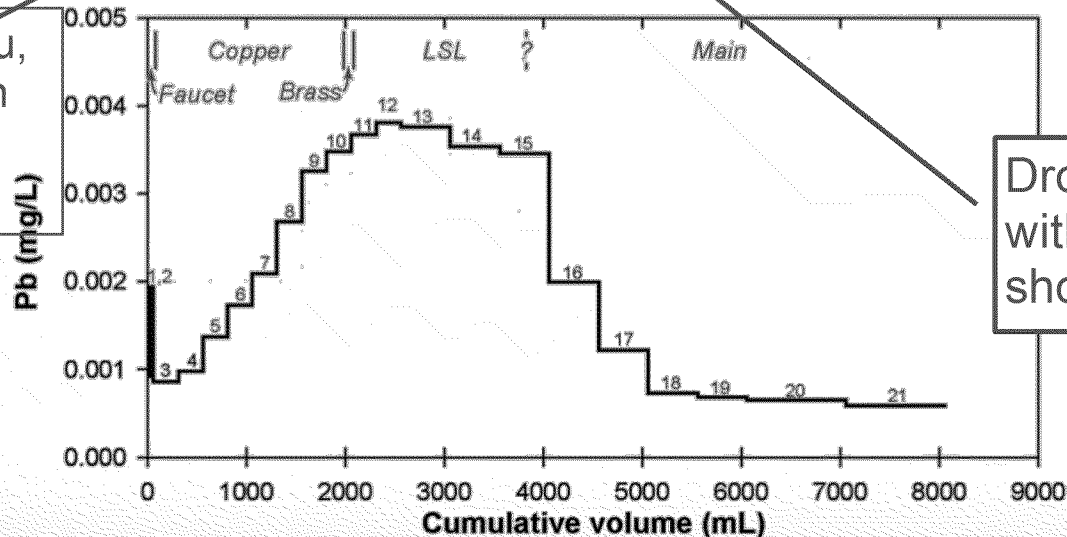
Including Cu, Zn and Fe is Very Useful

Consistent high Cu is interior piping



Higher copper with falling lead shows PLSLR

High Zn and Cu, associated with rising Pb is meter area

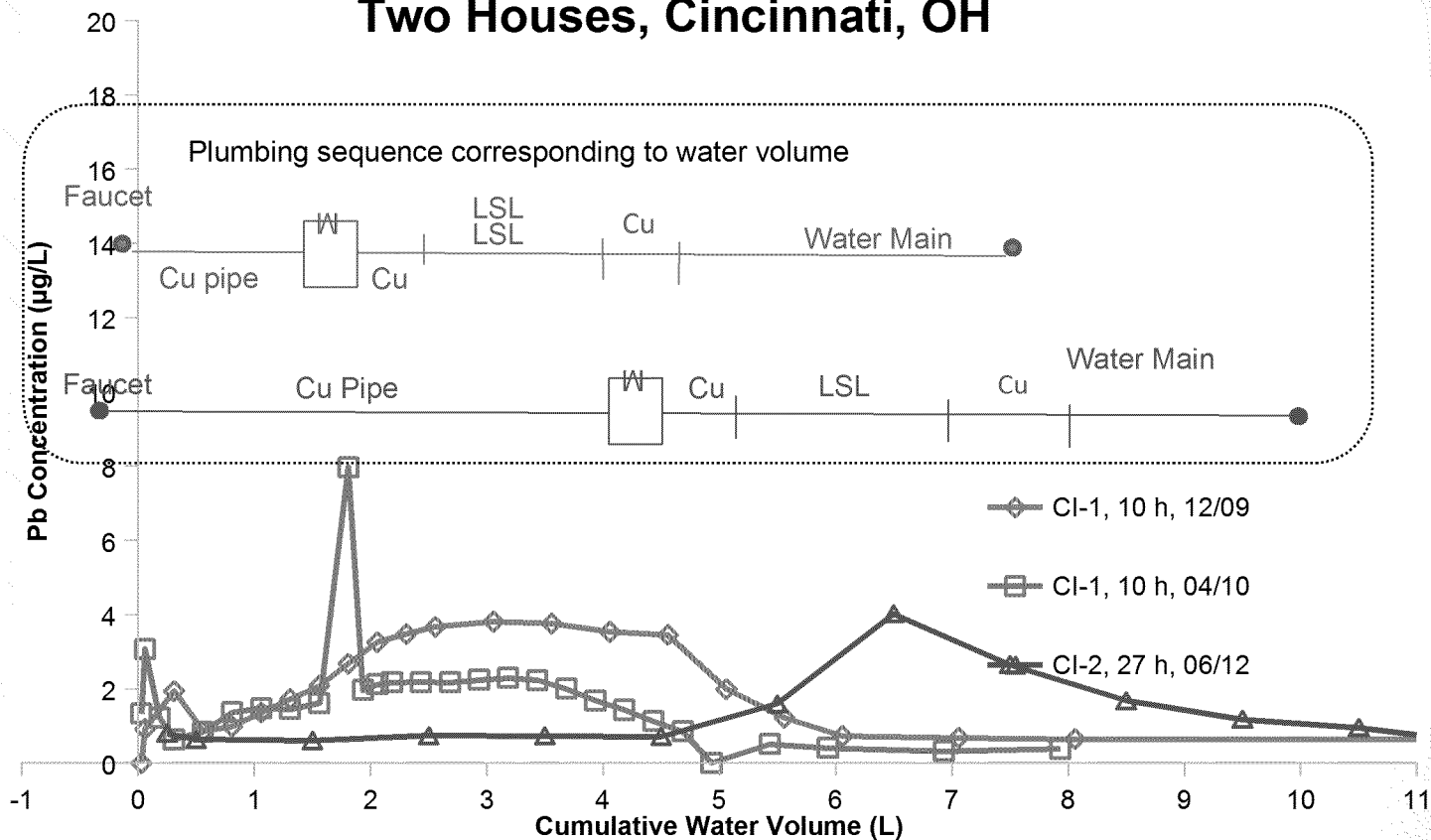


Dropping copper with dropping Zn shows LSL



Example Profiles of PbO₂ Scale House

Two Houses, Cincinnati, OH

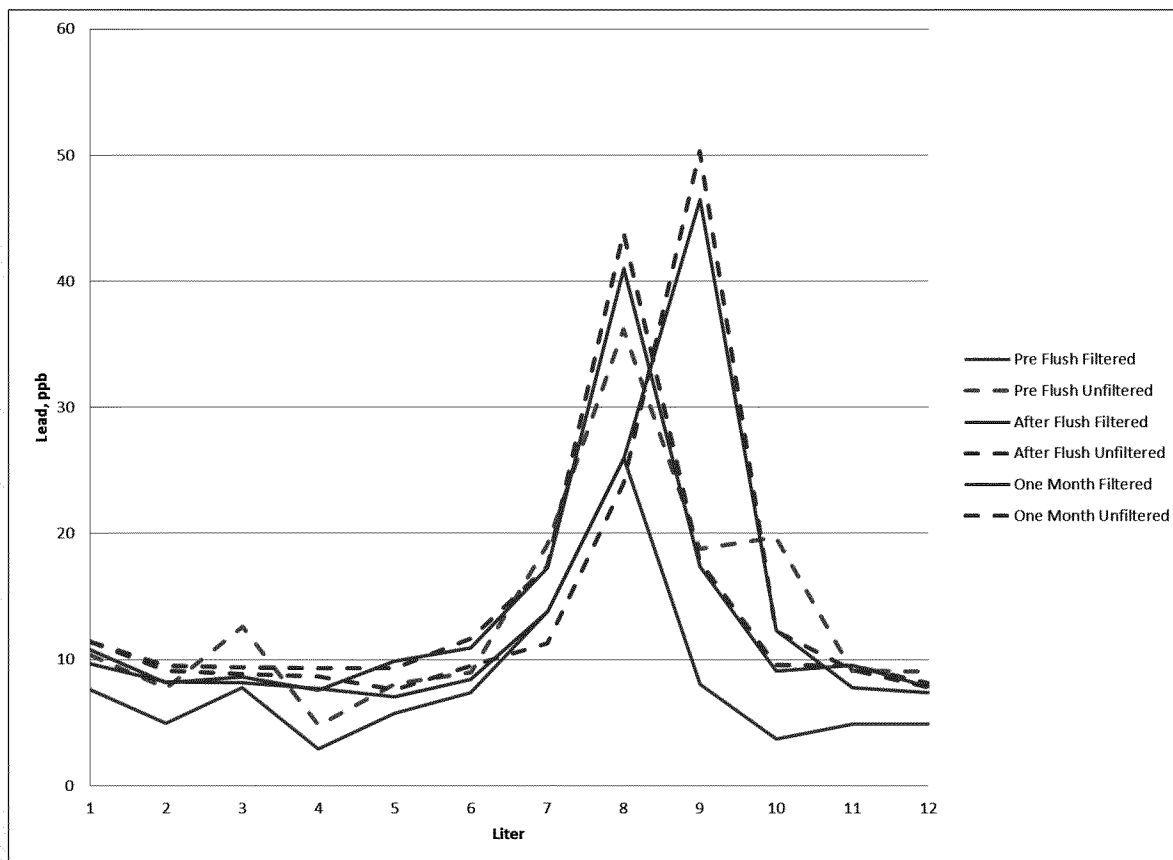


Peak lead at approximately 2.5 – 4 L, and approximately 6.5 L



Triplicate Profiles in a Different Area

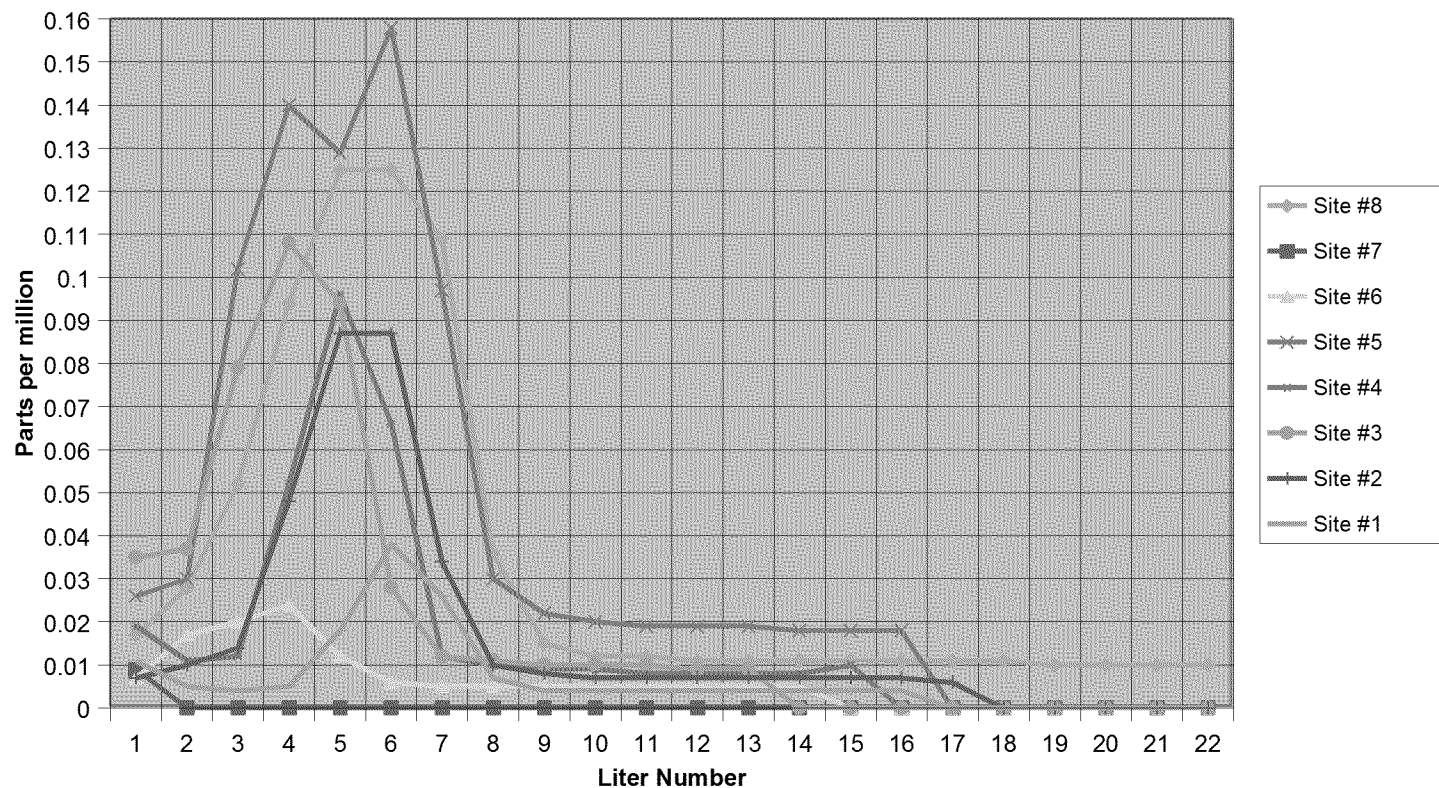
with no apparent difference in water age or water chemistry





LSL Profiles, Providence, RI

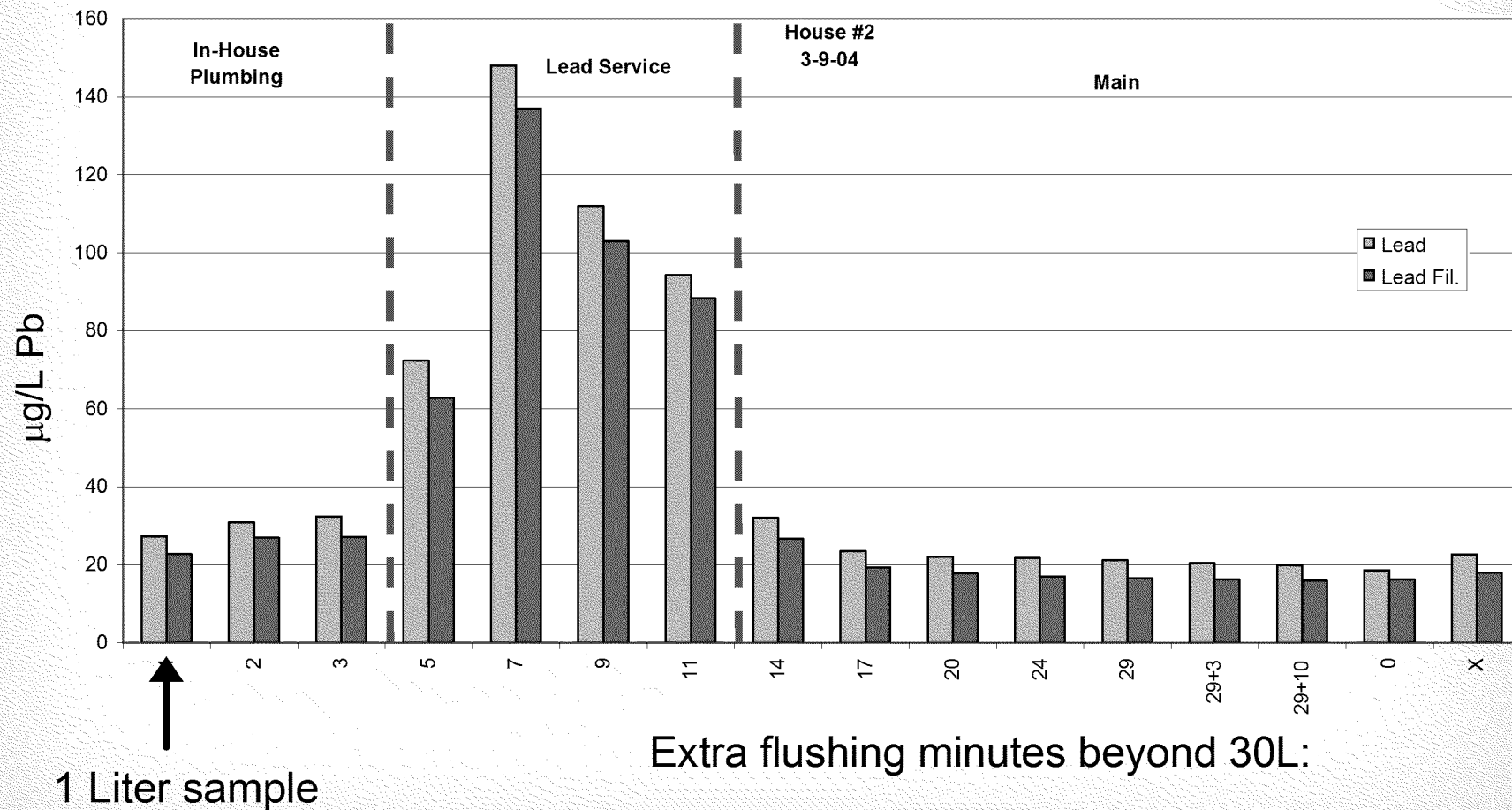
Lead in Drinking Water





First Draw May Not Reach Pb Contamination

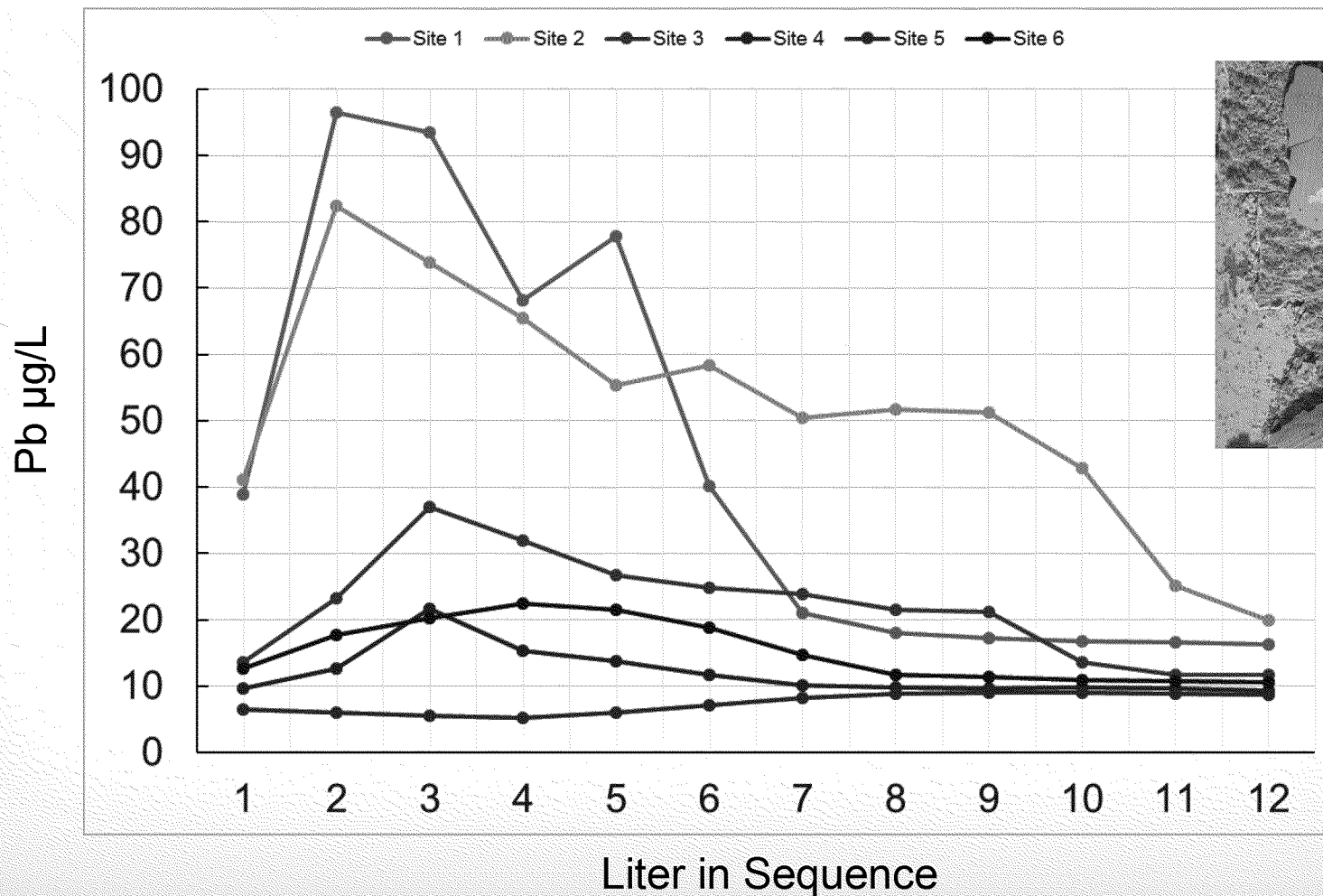
Need to "Profile" Sites for Public Education Flushing Guidance





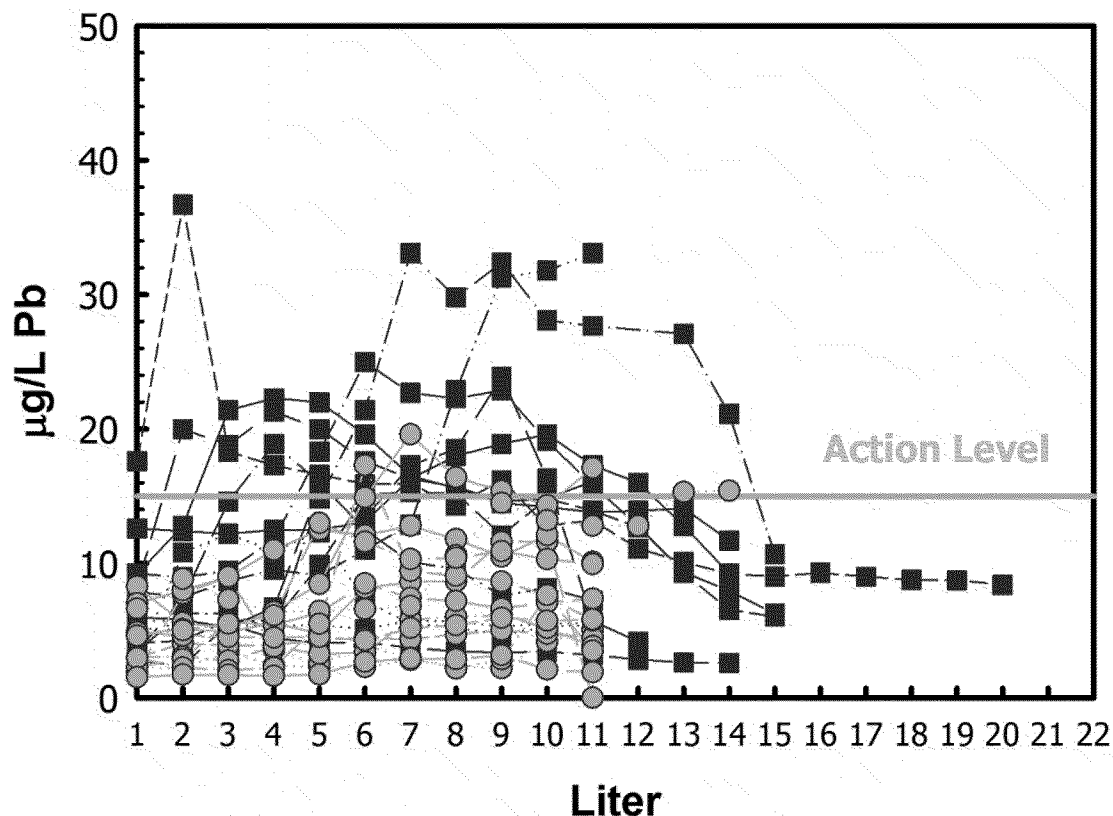
Pb Profile of Sites with Al-Si-Ca-Rich Deposit

< 10% Pb in surface scale, no crystalline Pb phases at surface





Impact of Disturbances in Past 7 Years Chicago (blended phosphate)

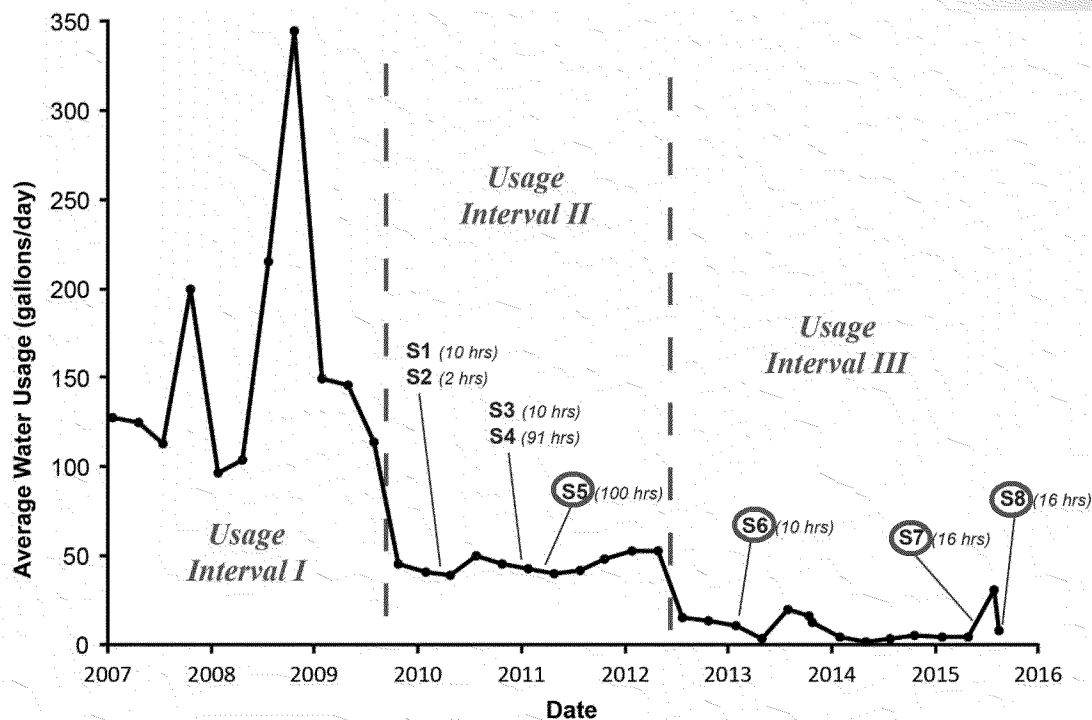
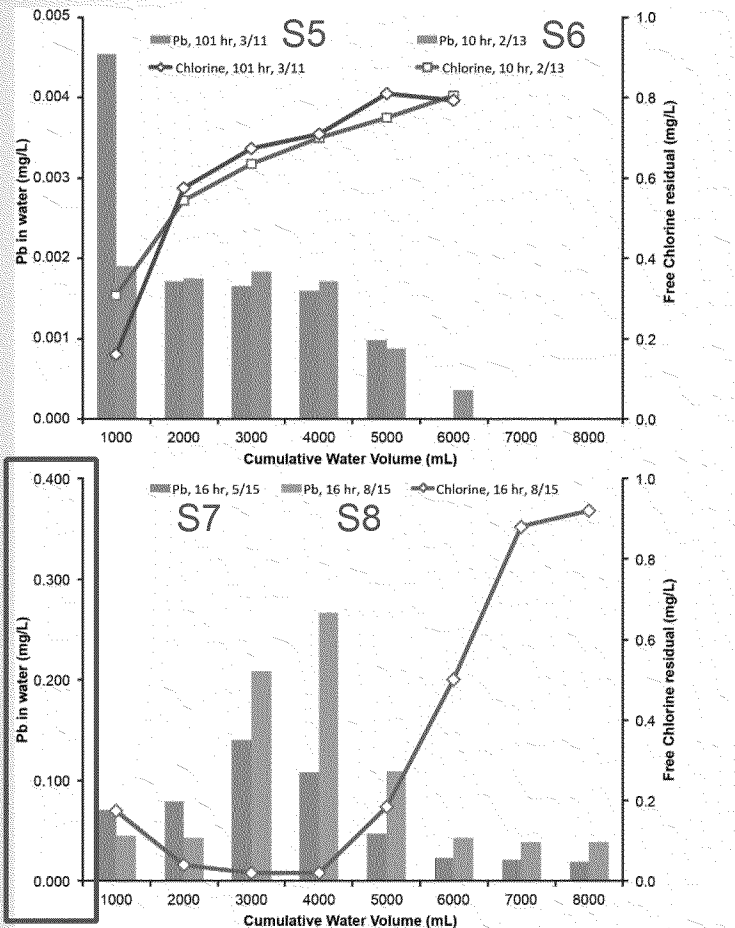


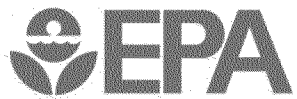
IMPORTANT POINTS

- Disturbed sites often double the Pb level
- Peak Pb liter varies with LSL length and plumbing configuration, consistent with other utilities that have done profiling
- Non-crystalline, amorphous scale
- Could not separate water use effect on lead levels



Beware of Vacant House & Low Use





Rule of Thumb from Profiling

- For systems with Pb(II) scales
- Peak Pb concentration in LSL \cong 4 to 8X 90th Percentile value



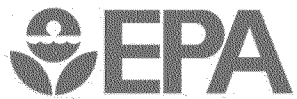
What Are the Risks of Leaving LSLs?

- Pb release can be high, erratic, or both, at any given site, *even with optimal corrosion control treatment*
- Infrastructure work (roads, main replacement, meters) will disturb pipe scales indefinitely
- Work on mains can leave air pockets that scour scale from inside LSLs and premise plumbing
- Utility may have to install extra treatment unit processes to remove interferences to passivation and lead release control
- Treatment changes, mistakes, accidents or natural disasters could mobilize massive quantities of dissolved and particulate Pb.



Approaches for Exposure Assessment

- Can be approached three ways
 - System-wide assessment of risk (population-based)
 - Targeted subgroup/pool of system, estimation of risk
 - Individual premise assessment of risk
- Demonstrated approaches by other countries or special studies
 - Random daytime sampling (RDT)
 - 30 minute stagnation, first liter (relies on leaded interior materials)
 - Proportional sampling apparatus



Approaches for Exposure Assessment (2)

- Promising future approaches amenable to bridging premise to community risk
 - Proportional samplers at taps of consumption in “representative” sites
 - POU-type filter units that aggregate and/or separate dissolved and particulate lead over known water use/time
 - Intensive RDT sampling at child exposure investigation sites, linked to water consumptive use (kind of manual “proportional sampling”)
 - Mathematical modeling of full profile, using simulated usage pattern (yet to be researched in US)

SAFE DRINKING WATER ACT 40th ANNIVERSARY

Top Line Messages

- Safe drinking water is central to our lives and essential for healthy communities.
- It was a giant step forward for public health when Congress passed the Safe Drinking Water Act.
- We've made incredible progress in improving the availability of safe drinking water during the past 40 years.
- Today the United States is a world leader in providing safe drinking water.
- There are many continuing and emerging challenges to providing safe drinking water.
- We have robust efforts underway to address the challenges and make drinking water even safer.

Supporting Messages

Safe drinking water is central to our lives and essential for healthy communities.

- Water truly is life - our bodies are two-thirds water; humans cannot survive without a clean and reliable supply of drinking water.
- Each day, Americans drink more than one billion glasses of tap water.
- Every day we rely on clean water from our taps for cooking, washing, and bathing.
- Clean drinking water is essential for our schools, businesses, and communities.

It was a giant step forward for public health when Congress passed the Safe Drinking Water Act on December 16, 1974.

- The Safe Drinking Water Act allows EPA to ensure the quality of the Nation's public drinking water.
- The Act is the primary regulatory framework for setting and enforcing national standards for drinking water quality.
- The Safe Drinking Water Act was amended in 1996 to include additional protections emphasizing comprehensive public health protection from the source to the tap, as well as establishing the loan program for financing infrastructure projects.

We've made incredible progress in improving the availability of safe drinking water during the past 40 years.

- 40 years ago, America's drinking water wasn't as reliably safe.
- Sewage, chemicals and trash were dumped into our rivers, lakes and oceans, so sources of drinking water were polluted.
- We lacked the authority, science, technology and funding to properly address the problems.
- The 1962 drinking water standards regulated 28 substances but a survey conducted by the Public Health Service in 1969 showed that only 60 percent of the systems surveyed delivered water that met those standards.
- Over half of the treatment facilities surveyed had major deficiencies involving disinfection, clarification, or pressure in the distribution system.

Today the United States is a world leader in providing safe drinking water.

- EPA has drinking water standards for more than 90 contaminants, including microorganisms, disinfectants, disinfection byproducts, inorganic and organic chemicals, and radionuclides.
- More than 300 million people depend on 50,000 community water systems across the country for safe, reliable water every day.
- Over 91 percent of the population supplied by community water systems receives drinking water that meets all health-based standards all of the time. Thanks to the Safe Drinking Water Act in 1974 and subsequent amendments in 1986 and 1996, we've improved public health protection from bacteria, arsenic, lead, disinfectants and disinfection byproducts.
- Residential customers pay on average \$2.89 for a thousand gallons of safe, reliable tap water.
- We've taken steps to ensure that safe and reliable drinking water is provided to aircraft passengers and crew.
- We've established a drinking water technology innovation center in the greater Cincinnati region to develop advanced solutions to safer drinking water.

¹There are many continuing and emerging challenges to providing safe drinking water.

- Drinking water infrastructure requires regular maintenance, repairs and replacement. EPA estimates that the United States has \$384B in drinking water infrastructure needs over the next 20 years.
- 97 percent of all public water systems are small, serving fewer than 10,000 people. Small systems face unique challenges, including aging infrastructure, complying with regulatory requirements, workforce shortages/high-turnover, increasing costs and declining rate bases.
- The drinking water from local utilities or individual wells comes from ground water, streams, rivers, springs or lakes. Source water is too often threatened by pollution or development. Two major drinking water systems were shut down in 2014 year alone due to source water pollution emergencies.
- Improvements in science and technology are revealing previously unknown contaminants in our water including chemicals, toxins, and pharmaceuticals.
- Climate change is bringing warmer temperatures, sea level rise, stronger storms, more droughts and changes to water chemistry. These pose challenges to protecting source water and drinking water infrastructure.

We have robust efforts underway to address the challenges and make drinking water even safer.

- Since its inception in 1997, the Drinking Water State Revolving Fund (DWSRF) has provided \$30.0 billion in funds for more than 12,400 drinking water infrastructure projects, including drinking water treatment systems, pipes for transmission and distribution of water, and storage.
 - EPA signed a memorandum of agreement with USDA/Rural Development in 2011 to increase the sustainability of rural drinking water and wastewater systems. The two agencies work together to assist rural systems in implementing short- and long-term strategies to ensure the protection of public health, water quality, and sustainable communities.
 - EPA is working with small drinking water systems to enhance their technical, managerial, and financial capability to reliably provide safe drinking water to their communities.
-

- EPA continues to coordinate numerous efforts to protect America's drinking water at the source – in the lakes, rivers, streams and aquifers we use for drinking water; protecting water at the source is one of the most efficient and cost-effective ways to ensure that communities have a safe drinking water supply.
- EPA convened the Source Water Collaborative, a partnership of over 25 organizations united to protect drinking water sources. Through the SWC, we will continue to promote innovative approaches to recruit new partners to promote source water protection efforts.
- EPA evaluates unregulated contaminants and determines whether new national drinking water standards are needed to protect the nation's drinking water supplies.
- Community water systems deliver Consumer Confidence Reports to their customers, which provide important information on the drinking water source and if a water system meets drinking water requirements, including what regulated contaminants are detected in the water.
- EPA has developed interactive climate adaptation tools like the Climate Resilience Evaluation and Awareness Tool (CREAT) to assist drinking water utilities in developing strategies to ensure that their facilities are resilient to drought, flooding and other extreme weather events related to climate change.
- We protect the security of our nation's drinking water by helping water utilities reduce vulnerabilities to potential terrorist attacks, plan for natural disasters and emergencies, and develop new security technologies to detect and monitor contaminants and prevent security breaches.

Recent Examples of Challenges

- **Example:** Flint, MI - In April 2014, the City of Flint ceased purchasing treated drinking water from the Detroit Water and Sewerage Department and began drawing water from the Flint River. Flint did not continue corrosion control treatment after changing its water source, resulting in elevated drinking water lead levels.
 - On October 16, 2015, EPA established a Safe Drinking Water Task Force comprising scientists and technical experts from EPA's Region 5 office in Chicago, the National Risk Management Research Lab in Cincinnati, and the EPA HQ drinking water program to provide technical assistance that supports state and city efforts to reconnect Flint's water system with Detroit and to optimize the Flint's system's corrosion control treatment.
 - On November 3, 2015, EPA issued a memorandum that clarifies how corrosion control treatment (CCT) should be maintained when a community switches to a new source of water.
 - On November 10, 2015, EPA announced that the agency's intentions to conduct an audit of the Michigan MDEQ drinking water program.

Example: Charleston, West Virginia – On January 9, 2014, approximately 7,500 gallons of MCHM and other chemicals leaked from a storage tank and its containment area at the Freedom Industries' Charleston facility, entering the Elk River 1 mile upstream from West Virginia American Water's (WVAW) drinking water intake. The Governor declared a state of emergency that evening; up to 300,000 residents were affected in 9 counties within the Charleston, West Virginia metropolitan area. The "do-not-use" advisory on drinking water was not lifted by West Virginia state officials until January 13, five days after it had been put into effect. Governor Tomblin estimated that the total economic impact from the emergency exceeded \$70 million.

Example: Toledo, Ohio – On Friday August 1, 2014, officials at Toledo’s Collins Park Water Treatment Plant notified OH EPA and US EPA of an elevated sample reading for the algal toxin Microcystin. On the morning of August 2, Toledo Mayor Collins issued a do not drink or boil advisory to more than 400,000 customers served by this public water system, leading to the declaration of a state of emergency by Ohio Governor Kasich and mobilization of the Ohio National Guard to provide emergency drinking water supplies to the impacted residents. The drinking water advisory and state of emergency continued for two days.

Example: New York and New Jersey – Hurricane Sandy struck the east coast in October 2012, causing widespread destruction, including the loss of service of many drinking water and wastewater treatment plants in the impacted area.

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IN FLINT, LEAD CONTAMINATION SPURS FIGHT FOR CLEAN WATER (MICHIGAN DAILY)

FLINT MAYOR OUTLINES HER GOALS FOR HER 1ST 100 DAYS IN OFFICE (MICHIGAN RADIO)

In Flint, lead contamination spurs fight for clean water (Michigan Daily)

<https://www.michigandaily.com/section/news/water-and-all-flints-ghosts>

The Flint Water Plant is quiet now that all of the Flint River water has been emptied from the plant and the city returns to Detroit Water.

Ruby Wallau/ Daily

Sam Gringlas

Managing News Editor

Wednesday, December 2, 2015 - 3:01am

FLINT, Mich. — On a Saturday evening in October, several hundred trick-or-treaters streamed up and down Calumet Street on the city's east side. Traffic clogged the neighborhood's streets, lined with well-maintained Tudors, Colonials and mature trees cloaked in hues of red and yellow. Princesses, ninja turtles, witches and firemen darted between the cars, and on their front lawn, Bob and Melodee Mabbitt passed out candy from beneath a rain umbrella. The Mabbitt's stretch of Calumet is wealthier than most of Flint's neighborhoods, and draws kids from all over town on Halloween. But this year, along with Snickers, Crunch bars and boxes of Nerds, the Mabbitts were handing out leaflets.

The letters were bold and black, and they warned Flint parents their kids may have been exposed to toxic lead from their drinking water. "You are getting this as a courtesy to let you know that one or more of your neighbors had their tap water tested and was informed they have very high contents of lead and other pollutants in their water," the fliers read. Nayyirah Shariff, a Flint community organizer and friend of Melodee's, slid the white, folded fliers into dozens of old pillowcases and plastic buckets shaped like jack-o'-lanterns. "Don't worry, there's candy, too," she assured a group of kids clad in raincoats. "Happy Halloween!"

In October, Michigan Gov. Rick Snyder (R) announced the city of Flint's drinking water contained elevated levels of lead. A local pediatrician's report the week before had shown a

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significant jump in the number of Flint children with elevated blood lead levels, and those samples correlated with ZIP codes in which independent water samples pointed to lead contamination. State officials initially discounted the data. Eight days later, they reversed course. The city would again source its water from the Detroit River. For the residents of Flint, it was too little, too late. They had been ringing the alarm over the city's water quality for more than a year, almost immediately after the city opted to treat its water in-house from the Flint River.

Flint had already planned to join a new pipeline, the Karegnondi Water Authority, which would eventually serve mid-Michigan and the state's thumb. Knowing Flint had plans to leave, Detroit's water authority said it would stop supplying water to the city. At the time, Flint was under the control of a state-appointed emergency financial manager who, in a cost-saving move, decided that while the city waited for the KWA to come online, Flint would treat its own water for the first time in decades. Residents say officials brushed off their concerns again and again. They reported that water ran from their sinks discolored in browns, blues and yellows. Then came the hair loss, rashes that wouldn't go away, rotting teeth, discolored shower tiles. In July, the city's mayor drank a glass of water on local morning television to prove the water was safe. It wasn't.

Flint resident Lee Walters shares a photo of herself holding up a water sample taken from her sink during a city council meeting.

Ruby Wallau/ Daily

Melissa Mays, a Flint mother of four, had brought us here, to Calumet Street. Mays, her husband, and their four sons were all diagnosed with lead poisoning last year, and she's spent months working with Shariff, clergy members, activists and a ragtag collective of Flint residents to pressure the city, the state, the feds — anyone, really — to do something. In their living room, about 10 minutes from Calumet, Mays' husband applied zombie makeup to all four kids, his own face and hands already covered in the white, red and black paint. Two candelabras decorated to look like they were covered in spider webs sat atop a tablecloth patterned with skulls. I slid into a chair next to Derek and Ruby, the Daily columnist and photographer who joined me on the trip. A row of electric guitars hung vertically across one wall, and another was plastered with the kids' drawings and class projects. Mays and Shariff, who had come over for the interview, were seated on the table's long side, and I asked how the whole debacle started. Mays spoke with dizzying speed, peppering a timeline of the last two years with talk of trihalomethanes, parts per billion, Freedom of Information Act requests and the federal Lead and Copper Rule. Mays is not a scientist or policy analyst, but it was apparent that, out of necessity, this research has ended up a full-time endeavor.

Not long after water started flowing from the Flint River and into taps and showerheads across the city, residents started noticing their water running yellow and brown. It smelled funny, and tasted strange, too. People were showing up at Flint City Council meetings displaying bottles filled with the brown-colored water. "It's a quality, safe product," Flint Mayor Dayne Walling

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said at the time. “I think people are wasting their precious money buying bottled water.” Four months later, water on the city’s west side tested positive for E. coli, and the city issued a series of boil-water advisories. Shariff said she only came across the alerts accidentally when clicking around the city’s website; Mays said she didn’t hear about them until after the third advisory.

By September 2014, Mays had enough; she was convinced the problem was more than just bacteria. She said her cat was throwing up, her own hair was falling out and a splotchy red rash had started to stretch across her face. Mays’ 2-year-old niece was staying in the house then, and every time she took a bath, the toddler broke out with a rash all over her behind. The rash covered only the body parts where the tub’s water hit. Eczema cream didn’t help, and the child’s doctor couldn’t figure out what was wrong.

“And I’m like, ‘What is happening to this kid?’ The rest of us were just used to it. Our skin was turning scaly,” Mays said. “My son — my middle child — just had rashes up and down his arms, and if you tried to put lotion on it — it just burned. It was chemical burns. It was on my face, my whole cheek bone. And any time you put anything on it, even makeup, you would just scream because it hurt so bad. But they’re on T.V. saying, ‘Water’s safe, water’s safe, water’s safe.’ ”

AUDIO: Hear Flint residents talk about their experiences with city water.

In January 2014, the city distributed a letter notifying homeowners that the city had violated the federal Safe Drinking Water Act — not for lead, but for total trihalomethanes. The city’s water was found to contain a high level of trihalomethanes — a cancer-causing chlorine byproduct. By this point, members of City Council called on the governor’s appointed emergency manager to abandon the Flint River water source, and the city of Detroit offered to start selling water to Flint again. But Flint’s emergency manager opted to stay the course. To investigate, residents called in a water activist, who told Mays not only that she shouldn’t drink the water, but that she shouldn’t cook or shower with it either. And if the city didn’t have a lead problem now, he said, they would soon. Mays didn’t know it at the time, but they already did.

“When you’re boiling the water to make spaghetti, you’re just making all of those heavy metals and all the contaminants basically bond together, and you’re basically eating poison food. When you wash your clothes, the heavy metals stay in the fabrics so it’s rubbing against your skin all day and god forbid you sweat, you’re going to absorb all of that through your pores. So I can’t wash my dishes here, I can’t do my laundry, I can’t move because I’m 16 years into a mortgage and nobody’s going to buy my poison water house.”

Mays takes us into the kids’ bathroom. A five-step instruction sheet for showering was taped to the wall, written by Mays in neat, black marker. Step Two: Sit down and as the tub fills, use the cup and faucet to wash your face and hair. Rinse well. Step Four: Brush your teeth in the sink using bottled water and small cups. Don’t forget Q-tips. “Love You!” is scrawled and underlined across the bottom. Next to it another reminder: “Brush Your Hair!” I asked how the kids took to the new routine. “It makes them angry, and then once we found out about the lead, I took out the letting the water fill up, so they just used a big cup to let it go over their heads,” she said. “So yeah, my 17-year-old son just loves that, to sit down and use a cup to shower and to use bottled water to brush their teeth.”

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Mays brought in an outside expert to test the water — Marc Edwards, a professor at Virginia Tech University who specializes in water treatment. She said she drove 62 of the test kits to neighborhoods across Flint, picked them up and helped residents complete them. The lead levels in water at Flint resident LeeAnne Walters' house was averaging 2,500 parts per billion. Her family was losing hair and developing rashes, too. The legal level is 15. In a September 2015 report, Edwards concluded that the corrosiveness of Flint's water was causing lead to leach from the city's aging pipes and into the water. The state maintained it was meeting all lead and copper standards.

An empty lead and copper water sampling bottle in the office of the The Flint Water Plant.

Ruby Wallau/ Daily

On Sept. 24, Dr. Mona Hanna-Attisha, a University alum and a pediatrician at the Hurley Medical Center Children's Clinic in Flint, cross-referenced that data with information the county already had — blood lead levels for infants at ages 1 and 2, which the state is required to test for kids who are at a greater risk of ingesting lead paint chips in older homes. What she found: The number of children in Flint with elevated blood lead levels — defined as 5 micrograms per deciliter or more — had increased from 2.1 percent in the 20 months prior to Sept. 15, 2013, to 4 percent between Jan. 1 and Sept. 15, 2015. In several ZIP codes, those figures increased from 2.5 percent to 6.3 percent during that same time period.

"Everyone who has challenged the narrative — which was 'the water is safe to drink' — they were minimized," Shariff said.

But the evidence built up, and eventually it was hard to ignore there was a problem. Finally, on Oct. 8, 2015 — nearly two years after Flint residents started drinking water from the Flint River — the state changed course and announced they had come up with a \$12 million deal to allow the city to return to Detroit water. "I'm in full support of the return to the Great Lakes Water Authority," Snyder said during the announcement. "We all care about the citizens of Flint." Snyder promised to convene a task force — which includes a University professor and several University alums — that would determine what went wrong. Detroit water would again run through Flint's pipes, and Flint's parents could rest easy knowing their kids' drinking water was safe.

But Mays says people shouldn't be so quick to chalk the case up as a crisis averted. The story of water in Flint is not confined to that period of two years when the city's water was unsafe for drinking — or by the final hurrah moment in October when the good guys fighting the good fight won the day. Flint's challenges also reach further, into a history colored by the population loss and decay that made it easy to brush the city aside, as well as into a future that these two years will in many ways shape.

A timeline of Flint's water struggles.

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Design by Emily Schumer

On the banks of the Flint River

You could argue the city of Flint, like a lot of cities, was born from the river. The confluences between city and water stretch back far — to a time when native people fought over the river's banks. A handful of fords, where the river could be easily traversed, made the land highly sought after. In 1819, before the great industrial might of Buick City generated wealth and helped the city's population grow, and before the city's slide into poverty and decay, a fur trapper and his wife set up a post near the river's banks. For the traders who came here — and to Michigan, a territory hugged on four sides by the Great Lakes — water was life-giving. The rivers provided habitat to beavers, and the water ferried birch-bark canoes downstream, piled up with pelts for sale back East and across the vast Atlantic.

In later years, Michigan's rivers and lakes were clogged with logs, floated downstream for processing into lumber that would build this nation's cities. The water fed the state's growing agricultural economy as well as the companies that empowered the United States' industrial might — industries that allowed old lumber towns across the Rust Belt to boom, before they would hemorrhage wealth and population a few decades later. Today, water is the basis for Michigan's wildly successful "Pure Michigan" advertising campaign, which helps drive the state's vibrant tourism industry in the towns dotting Lake Michigan. For a whole lot of Michiganders, their Michigan and their Midwest does not include the vast and aging networks of pipe that snake beneath the earth, nor the sediment-colored water of the rivers Rouge, Flint, Detroit and Saginaw.

"We connect to water very emotionally, we love our water, it's Pure Michigan, it's why that ad campaign really sings to us," John Austin, a University of Michigan lecturer and co-author of a report on Michigan's 'Blue Economy,' told me during a phone interview later in the week. "And so we appreciate that even more than this hidden water infrastructure that brings us clean water and is essential to basic life and health."

Today, one in five jobs in Michigan are linked to water, and Austin said the state could play a major role in developing innovative ways to use water more efficiently, particularly as water resources grow increasingly strained. But as much as Michiganders — residents of a state whose surrounding Great Lakes contain 20 percent of the world's surface freshwater supply — love their water resources, Austin says it's easy to forget about the hidden infrastructure that delivers fresh water to taps on demand.

"What Flint really illustrates is ... as a first order of business, we depend on water for life and that water has to be clean and available to people," he said. "What Flint exposed is our water infrastructure — that in every community in Michigan we've got aged infrastructure and this shows that since we haven't invested in remaking our water infrastructure — in rebuilding those systems — they can potentially kill us."

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For Austin, this dynamic illustrates the need to invest not only in infrastructure above ground, such as roads and bridges, but also in the infrastructure that sits below the surface. With debate over paying to fix Michigan's roads reaching a boiling point last spring, Austin said people should be just as concerned with the invisible infrastructure — particularly the pipes that shepherd clean drinking water into our homes every day.

The Flint Water Plant is quiet now that all of the Flint River water has been emptied from the plant and the city returns to Detroit Water.

Ruby Wallau/ Daily

Through the pipes, below the ground

After Halloween, I spent a week trying to get into Flint's water plant. When I spoke to Mike Glasgow, the city's utilities director, on the phone, he told me how excited he was to hear young people were interested in municipal water delivery. But in the days leading up to the final reporting trip to Flint, the woman who handles his schedule kept telling me to call back later; she hadn't had a chance to nail anything down. By Thursday evening, I wasn't getting any response at all. I decided I would just show up at the facility anyway.

The Flint Water Treatment Plant sits on a sprawling campus just off the freeway. The complex is circled with tall chain-link fencing topped with barbed-wire spirals. A long driveway leads up to the main building, which is sand-colored and doesn't boast much in the way of decorative finishes. A white water tower hulks above the building, around which another half-dozen smaller structures are gathered. Only a handful of cars congregated in the parking lot, and a sign in one of the front windows indicated the office entrance is around back. Inside, the plant's office was drab and dated. Paper maps hang on the paneled walls, and a collection of empty lead and copper water sampling bottles rest on a shelf nearby. I found Brent Wright, the plant's supervisor, in an office lined with dozens of binders. Wright looked understandably confused when we enter. "Hi, we're here for a tour of the plant," I said enthusiastically. "Mike knows we're coming." I only half-lied. I started to sweat a bit when he dialed up Glasgow to make sure the story checked out, but when Wright hung up the phone, he told us, "The best place to start is from the beginning."

Flint's first water treatment plant was built in 1917. The original red brick building stands a few hundred yards from the present facility, and looks a lot like an abandoned automobile factory. Many of the square panes of glass are smashed in, and Wright tells me the roof collapsed a few years back. The city built a second facility, the current plant, in 1952, but it would only operate fully until 1967, when the city stopped treating its own water and started buying it from Detroit. During the peak of Flint's prosperity and population, when sprawling factories turned thousands of GM cars off production lines, both plants together pumped 100 million gallons of water per day. Today, with most of those factories shuttered and the city's population significantly depleted, the Flint plant was only pumping about 16 million gallons daily when it last operated in October. In 1960, 196,940 people lived in Flint, according to the U.S. Census.

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Today, 99,002 people call this 33-square-mile city home.

With the city back on Detroit water, there wasn't much going inside Flint's water treatment plant during the visit. The final gallons of Flint River water had just been emptied out the week before. A few construction workers wearing hard hats moved through the massive building's darkened cement corridors, getting the place ready for the KWA pipeline to go live a few years down the road. The process for cleaning and distributing water is not incredibly simple. Wright is well versed in it after 25 years working his way up at the plant. First, the water is pumped from the river. Until it's pumped back out of the factory as clean drinking water, that's the only part of the process that isn't propelled by gravity. From there, the water is lifted into chambers for ozone treatment, created by putting together electricity, oxygen and nitrogen, which kills much of the bacteria.

The Flint Water Plant is quiet now that all of the Flint River water has been emptied from the plant and the city returns to water from the Detroit river.

Upstairs, where generators create this ozone, I asked why didn't the plant know there would be a corrosion problem, and add corrosion control into the process. Water is corrosive by nature, but after years of industrial waste dumped into the river, it was especially so. "Basically, by being a softening plant, we didn't think we were going to need corrosion control," Wright said. "It was brought up in a meeting and the DEQ said, 'No, let's wait and see what your lead and copper sampling is and then we'll look into corrosion control.' " Wright went on to say that the switch back to Detroit was unnecessary and that the city could have handled the problem on its own. "Yeah, we could have taken care of it," he said. "We're doing it now. We're setting up corrosion control now because they're saying this water has stripped some of the heavy phosphates out of the pipes over this last year that had built up when we were on Detroit water, so we're adding more phosphates."

Wright led us through the plant's laboratory, where glass jars, beakers, lab coats and clipboards lined the walls. From there, we followed a series of dim hallways into a massive room where sediment is removed from the water. A catwalk stretched across a giant reservoir-like chamber I figured could hold the water of several dozen swimming pools. Without the lights on, seeing the bottom proved difficult, even as we moved across the walkway suspended directly over it. Back when water was still held here, enormous paddles would have rotated through the water, pushing sediments to the bottom and separating them from the clean water. Peering down into the empty vat felt like standing on a deserted basketball court after the floodlights have been turned off and the crowds have all gone home.

While Wright kept talking about turbidity, lime and filtration, I couldn't get over the bigness of the whole thing — not only the millions of gallons that once moved through this place each day, but also the weightiness of the task at hand. That charge — to ensure the safety of the water that makes its way into your toddler's bathtub, mixes your baby's formula and washes down your grandpa's heart medicine — is clearly a heavy burden, a task that's unquestionably important to get right.

Policy failure

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The debate over what happened in Flint will likely continue for some time. The governor has convened an independent task force to investigate, and the EPA is releasing their own report on the situation. A recent Michigan Radio [report](#) suggested the state told city officials to leave two incredibly high water samples off their official water test report — allowing recorded lead levels in the water to remain below the legal threshold. Many of the sources said they thought officials should be fired, and some should get jail time for what happened in Flint. I had hoped to ask Walling, Flint's mayor, about all of this, but his press secretary instead offered Howard Croft, head of the city's Department of Public Works. Walling had the day before received an early punishment from the city's residents: His bid for re-election was defeated.

A few days after Croft asked to reschedule the interview, he resigned. "It is with deep sadness that I tender my immediate resignation," the longtime Flint resident appointed to oversee the water switch wrote in a statement. "With the city engaged in transition and working to regain public trust, I believe that now is the right time for me to step down from this position."

It's hard to argue that elected and appointed officials didn't majorly drop the ball on a lot of levels. Whether that's the result of negligence, malintent or political weakness, people disagree. Edwards, the Virginia Tech professor, says it was the Michigan Department of Environmental Quality's job to ensure the city managed the switch appropriately. Glasgow, the utilities manager, said the state told him to take two particularly high samples off his report. "They instructed me to take it off the report," he [told](#) Michigan Radio in October. "I don't know that I can give you a good enough answer to tell you why they decided to remove it from the report." The house those samples came from? LeeAnne Walters'.

Walters said the city was also padding its reporting with loopholes in the federal Lead and Copper Rule that allowed the city to pre-flush the water for five minutes before taking a sample and to use narrow-mouthed bottles that required a slower water stream and wouldn't show accurate lead readings. She said those loopholes must be closed, and she's already lobbying government officials to do so. A Detroit pastor recently filed an unsuccessful petition with the state Board of Canvassers to get a proposal on the ballot to recall Snyder for his failure to intervene in the water crisis. Several lawsuits have also been filed, including one in which Mays is listed as a complainant and another [class action suit](#) against Snyder, Walling and 10 other state and local officials, including Croft and Glasgow.

"What (we) would say is that we're focused on moving forward and ensuring public health and clean, safe drinking water," Snyder's press secretary Sara Wurfel told The Flint Journal after the filing. "The governor has outlined a detailed multiple step action plan for both immediate, mid and long term."

No resignations are going to alleviate the scars left by lead. But as finely woven as this issue is — with complicated timelines, players and literal chemical equations — maybe it's actually pretty simple. Government officials messed up big time, and a majority Black city with some of the state's poorest residents had to pay for it. No matter how you spin it, public policy failed. Officials did not serve the people they had promised to protect.

I thought about what Walters said at her kitchen table when I asked her whether she thought

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the mayor didn't step in because he didn't want to or because he didn't have enough power to do anything. "That's a loaded question," she told me. "I've debated that with people many times. I always get the, 'Well, in politics...' Well I don't want to hear about politics. Every politician has a human side, and I don't care what the politics of it is. Knowing that children were being poisoned, you stand up and you do what's right, and if you don't do that, then you don't deserve to hold the position that you have. You are there because the people put you there. You should be doing what your citizens need to do. Even if you don't have the power to make a change, you have a voice, you stand with your people."

Flint resident Lee Walters demonstrates the slow water stream used by the the city to pad its federal Lead and Copper tests in her relatives kitchen on Nov. 6, 2015.

Ruby Wallau/ Daily

Beyond all the blame passing, if we can't expect and trust that our drinking water — a resource people literally can't live without — will be clean and safe, then Flint residents have started asking who and what can we trust? I would imagine that's what a lot of folks in Flint are thinking through when they wake up to brush their teeth or wash their faces before bed. And that has incredible ramifications.

"I think there's a serious trust issue in this community," Hanna-Attisha said. "We're in 2015, we're in the middle of the Great Lakes and we don't have access to safe drinking water. And we trust that our government regulates these things. There's rules that will ensure that public health is protected. It's mind-boggling that it's not. And if these rules are not going to be strengthened or enforced, then the public needs to take it on their own to make sure that they have access."

In Flint, change occurred when residents, not public officials, called foul. "Our residents were complaining for months and months that their water was brown, it smelled bad, it tasted bad, there was E. coli in it and in other communities with louder, more affluent voices, it wouldn't have lasted this long," Hanna-Attisha said.

I asked Mays if she thought this would have happened in a place like Bloomfield, Ann Arbor or Farmington Hills, the city where I'm from. With a median household income of \$24,834, Flint is a city where 41.5 percent of residents live below the poverty line. She cut in before I could finish. "No."

"People don't want to acknowledge that there's been a problem," Shariff said. "This isn't like a hurricane where stuff is happening that you have no control over. This isn't an act of god."

Mays interrupts her. "This problem is man-made."

Though the problem was finally illuminated, it was not by government regulators, health officials or elected leaders, but by regular people like Mona Attisha-Hana, Melissa Mays and LeeAnne Walters. Attisha-Hana is a pediatrician. Mays does PR for a radio station. Walters is a

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stay-at-home mom. The community forced action from the city and state. Sure, residents acted with the interests of their own kids in mind, but also seem to have been driven by something bigger: by a sense that they owed something to their neighbors.

I wonder whether the dynamic in Flint — where the community was forced to serve as sole government watchdog — will simply become the new paradigm there, or whether the events of the last two years will spur some kind of wake-up call reverberating through city halls, water treatment plants, statehouses and governor's mansions all across the country.

Future in Flint

For Mays, the switch back to Detroit water hasn't changed much in her day-to-day life. The family still runs all their drinking water through a blue filter they keep on the fridge's top shelf. The corrosive river water likely wore away the phosphate coating on the city's lead pipes — and that could take years to build back up again. There are also the physical markers left by lead.

"Well now, my kids got to get tutors," Mays said on Halloween, as her kids prepared their costumes in the next room over. "I talked to my son's teacher this week and he's struggling in algebra, something he did great in before all this. My youngest, same thing. My middle child, has since he was younger, they've always wanted to bump him up, bump him up. He's got his first C and I'm beyond furious. Not to mention the physical things. My oldest has two holes in his teeth, on the smooth sides. That doesn't happen unless your teeth are crumbling from the inside out and the dentist said that's because of the lead poisoning. And they're all adult teeth, so what's he supposed to do, get dentures? And then the fact that my son fell off his bike and he had two buckle fractures on his wrist from catching himself, just falling over. That means his bones are weak. He complains all the times about how his bones hurt. 'My back hurts, my leg hurts, Mom.' Because you have severe bone pain with lead poisoning and I've got the same thing.

"I feel horrible. I want to help them, and there's nothing I can do as a mother and that infuriates me because people did this to us, people allowed it to continue to happen, they didn't speak up. The citizens who are sick spoke up and that's not our job, but it's become our lives and there's people worse off than me who can't afford the medications, can't afford the extra doctors."

Hanna-Attisha says the costs of Flint's water debacle will have ripple effects decades and generations down the road.

"When the kid is 5, they're going to need special education, when that kid is 10, they're going to get an ADHD diagnosis and have behavior problems," Hanna-Attisha told me during one of our telephone conversations. "And when that kid is 16, they're going to have problems with the criminal justice system. Imagine what that does to an entire population. So we have just shifted the entire population curve — their IQ curve. We've lost all of our high-achieving 130 kids who are going to go to U-M, who are going to come up with the next cure for cancer and we have

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now tons more kids with low 70 range who need more remedial services. As a population, it is absolutely damning. The state thinks they solved the problem when they went back to Detroit water. The money they gave is a down payment. This is a long-term problem.”

“Those are dreams derailed,” Shariff told me. “Because people have hopes and aspirations and because being exposed to lead and copper, they’re going to have to create a new paradigm.”

Whether lead poisoning will necessarily land a whole generation of kids in jail, it’s hard to know. But a lot of the problems wrought by Flint’s water crisis aren’t going to fade away easily. Their appearance in The New York Times, and on the policy agendas of government officials very well might, but the physical and emotional ramifications will likely linger for a long time. Walters, who recently relocated to Virginia but returns to Flint to keep stoking the fight for clean water, isn’t letting her kids drink the tap water in their new home. Not until it’s tested, at least. Even outside of Flint, one of her sons has started asking whether the water is safe to drink each time he wants to drink a glassful.

By 7:00 on Halloween, the rain wasn’t letting up on Calumet Street, and it was starting to get dark. Mays asked if we wanted to walk with her for a while longer. Mayor Walling, who lives a couple blocks over on Court Street, was up for re-election on Tuesday, and Mays had plenty of door hangers to hand out for that cause, too. I was hungry and needed to go to the bathroom, so we declined. I didn’t want to do any of those things in Flint, in the city where the water had been poison.

We got in the car, set the GPS for home, and left Calumet. We left the Mays family, the trick-or-treaters, the Flint River and the whole city behind us. Our Chevy barreled down U.S.-23 toward Ann Arbor — where that night I would turn on my faucet to wash my hands, fill my lazily cleaned pots with water, rinse off dishes stained with Prego and then let the shower’s hot water pour over my face, settling into the metal drain below my bare feet. I envisioned the water rushing through the walls and then under the city’s streets, houses and parking lots, moving through the pipes like some kind of trick-or-treat ghost.

Flint mayor outlines her goals for her 1st 100 days in office (Michigan Radio)

<http://michiganradio.org/post/flint-mayor-outlines-her-goals-her-1st-100-days-office#stream/0>

By [Steve Carmody](#) • 20 hours ago

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Flint’s new mayor has laid out her priorities for her first hundred days in office. Not surprisingly, the plan largely reflects the issues she stressed in her campaign.

“I’m not trying to do it by myself,” Flint Mayor Karen Weaver told a small audience at city hall, “I need all of you, and the people that are out there, to help.”

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Credit Steve Carmody / Michigan Radio

Karen Weaver defeated incumbent mayor Dayne Walling in last month's election. She's been on the job for nearly a month.

Even though roughly a quarter of her first hundred days have passed, the mayor says now was a good time to update people on her plans for her first 100 days.

A top priority for the mayor is having Flint's problem plagued water system declared a federal disaster. The decision to switch the city from Detroit water to the Flint River lead to numerous problems, including high lead levels in the drinking water.

Mayor Weaver says she's talked with Michigan U.S. Senators Debbie Stabenow and Gary Peters about the problem. She hopes to recruit other congressional and state lawmakers to help lobby for the designation.

Along with fixing Flint's water, Weaver says during her first hundred days she wants to make progress toward returning the city to total local control.

Flint was run by an emergency manager, appointed by the governor, for much of the past four years. The last emergency manager left in April. But decisions by elected city officials can still be overruled by a transition advisory board. Weaver hopes to hasten the end of that last level of state oversight.

Weaver says there are other issues she wants to address during her first 100 days in the mayor's office, including a review of Flint's still wobbly city finances and the creation of programs for the city's children.

Weaver admits not everything in her 100 day agenda will be completed in her first 100 days. She also admits she needs help.

"I'm not trying to do it by myself," Weaver told a small audience at Flint city hall, "I need all of you, and the people that are out there, to help."

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State says blood-lead levels in **Flint** kids have dropped

Leaderstandard.com (blog)

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To: Kaplan, Robert[kaplan.robert@epa.gov]
Cc: Kempic, Jeffrey[Kempic.Jeffrey@epa.gov]; Poy, Thomas[poy.thomas@epa.gov]; Schock, Michael[Schock.Michael@epa.gov]; Deltoral, Miguel[deltoral.miguel@epa.gov]; Henry, Timothy[henry.timothy@epa.gov]
From: Lytle, Darren
Sent: Sat 12/5/2015 1:59:35 PM
Subject: Next week

I saw we have a call next Wednesday. Mike and I will be in Flint on Tuesday and Wednesday. Flint's advisory team was supposed to meet on Wednesday but it was cancelled. We are going anyway and already have a packed schedule. In fact, I just saw a meeting was scheduled at the same time as our task force calls. With that said we probably will not be on the calls. Was anyone else on the task force coming or interested in joining us next week? I think we potentially have some important meetings set up with city, county health department and medical folks. I am also looking into a tour of Detroit's Lake Huron plant.

Darren

Sent from my iPhone

On Dec 4, 2015, at 5:56 PM, Kaplan, Robert <kaplan.robert@epa.gov> wrote:

Task Force,

FYI. Also includes the data in a link. -- Bob

Robert Kaplan

Deputy Regional Administrator

U.S. EPA Region 5

Phone: (312) 886-1499

Cell: (312) 515-9827

Fax: (312) 692-2075

From: Sygo, Jim (DEQ) [<mailto:SygoJ@michigan.gov>]

Sent: Friday, December 04, 2015 7:37 AM

To: Kaplan, Robert <kaplan.robert@epa.gov>

Subject: Blood Levels

Bob,

Separate story covered the rest.

Hurley study looked at samples over 2 consecutive summers which increased the numbers slightly.

<http://www.freep.com/story/news/local/michigan/2015/12/03/flint-kids-lead-levels/76746474/>

To: Michael Schock
From: Lytle, Darren
Sent: Mon 12/7/2015 12:00:35 AM
Subject: RE: Dec 9th 12-2
Schock Pb Occurrence CCT DAL.pptx

Personal Email / Ex. 6

I made some small changes on the talk, added a title, and disclaimer. Honestly I do not have time for this now. Too many people to speak with and information to collect (City, Detroit, County, etc..). We should have pushed this back. This could also turn into something bigger also. Can we run over there to Lansing Tuesday night or even on the way up on Tuesday?
Darren

Darren A. Lytle, Ph.D., P.E.

Branch Chief (Acting)

U.S. Environmental Protection Agency

26 West Martin Luther King Dr.

Cincinnati, Ohio 45268

Phone: (513) 569-7432

Fax: (513) 487-2543

email: lytle.darren@epa.gov

From: Michael Schock
Sent: Sunday, December 06, 2015 6:39 PM
To: Lytle, Darren <Lytle.Darren@epa.gov>
Subject: Re: Dec 9th 12-2

Personal Email / Ex. 6

Personal Matters / Ex. 6

Deliberative Process / Ex. 5

Mike

From: "Lytle, Darren" <Lytle.Darren@epa.gov>
To: Mona Hanna-Attisha; **Personal Email / Ex. 6**
Cc: "Schock, Michael" <Schock.Michael@epa.gov>; "Michael Schock (mrschock@yahoo.com)" <mrschock@yahoo.com>
Sent: Sunday, December 6, 2015 5:45 PM
Subject: RE: Dec 9th 12-2

Deliberative Process / Ex. 5

Darren A. Lytle, Ph.D., P.E.

Branch Chief (Acting)

U.S. Environmental Protection Agency

26 West Martin Luther King Dr.

Cincinnati, Ohio 45268

Phone: (513) 569-7432

Fax: (513) 487-2543

email: lytle.darren@epa.gov

From: Mona Hanna-Attisha **Personal Email / Ex. 6**
Sent: Friday, December 04, 2015 12:10 PM
To: Lytle, Darren <Lytle.Darren@epa.gov>
Cc: Schock, Michael <Schock.Michael@epa.gov>; Michael Schock
Personal Email / Ex. 6
Subject: RE: Dec 9th 12-2

Deliberative Process / Ex. 5

Darren, any thoughts on an available time to chat that am with some of the five guys. Would 8-9am be ok?

From: Lytle, Darren [<mailto:Lytle.Darren@epa.gov>]
Sent: Friday, December 04, 2015 11:41 AM
To: Mona Hanna-Attisha
Cc: Schock, Michael; Michael Schock **Personal Email / Ex. 6**
Subject: Re: Dec 9th 12-2

Deliberative Process / Ex. 5

Darren

Sent from my iPhone

On Dec 4, 2015, at 10:39 AM, Mona Hanna-Attisha wrote:

Personal Email / Ex. 6

We have you guys scheduled from 12-2pm in the Hurley auditorium to share your wisdom. The auditorium seats 200 people with powerpoint, projecting, livestreaming and recording capabilities.

As of now, I have your talks called "Flint Water 101". Do you have additional topics, titles, etc – corrosion control basics, lead and copper rule, opportunistic infections, background, continued monitoring, next steps, etc. Do you have short bios I should include?

The TAC members will be invited, as well as anyone else who is interested. Let me know who you think the intended audience should be.

We'd ideally like to send out the details later today if possible.

Lastly, a couple of the five guys (governors task force) want to very informally meet with you guys in the morning of dec 9. Just for background basic info – not even a real meeting. They are nice and normal. Let me know if you guys have free time early that am. I think a few of them will also be at our noon talk.

Thanks! Mona

Mona Hanna-Attisha MD MPH FAAP

Program Director Pediatric Residency

Hurley Children's Hospital at Hurley Medical Center

Michigan State University College of Human Medicine

Department of Pediatrics and Human Development

Personal Email / Ex. 6

Lead Corrosion and Water Sampling 101

Mike Schock

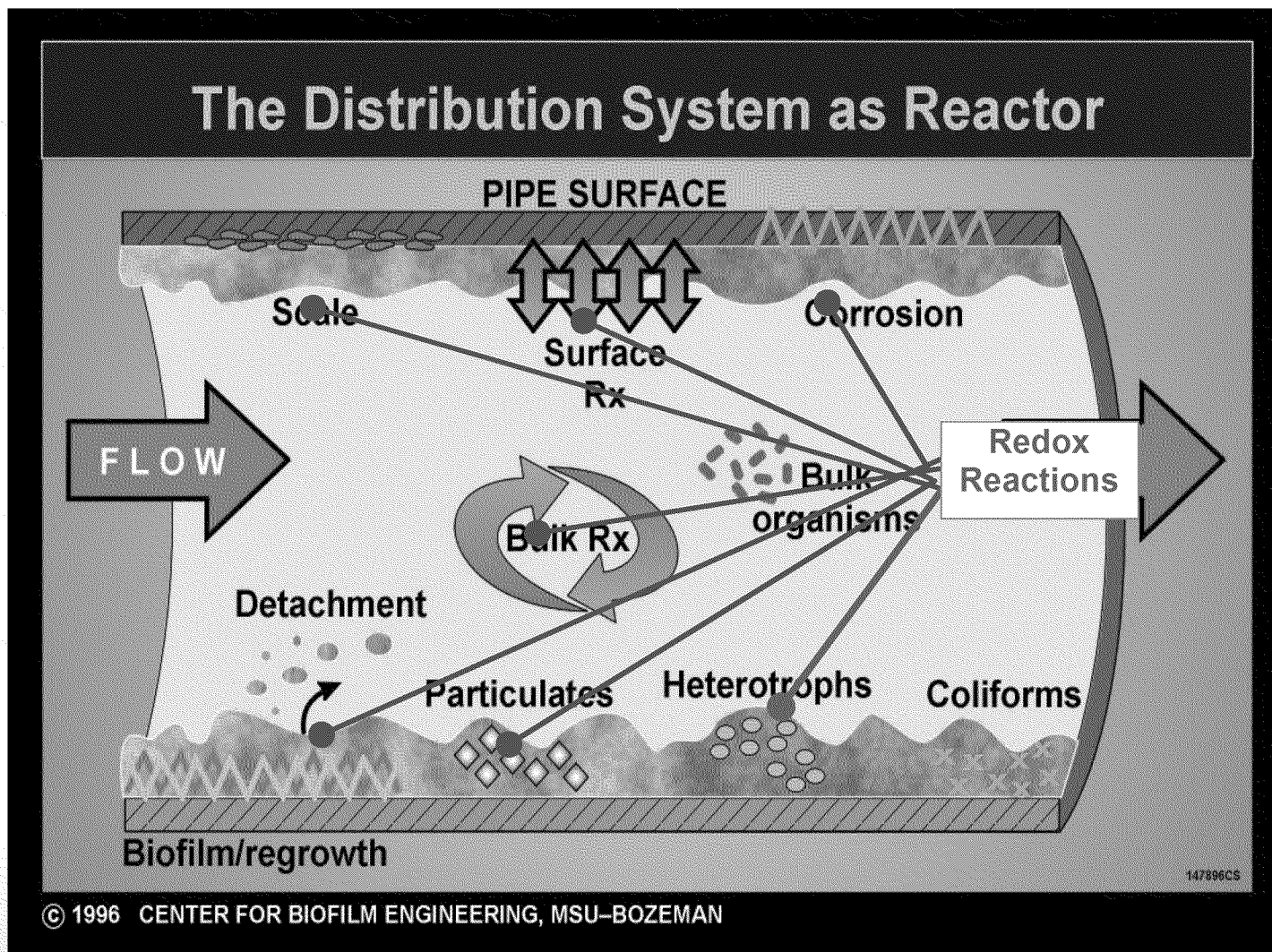


Main Points

- Corrosion, metal release, and transformation in the distribution system to tap
- Sources of lead in household plumbing
- Intentional central water treatment approaches for lead release control, and some accidental deposits that influence it
- Two minute overview of the Lead and Copper Rule and why it should NOT be assumed to be protective at an individual house
- Diagnostic sampling approaches to identify sources
- Thoughts on approaching exposure evaluation



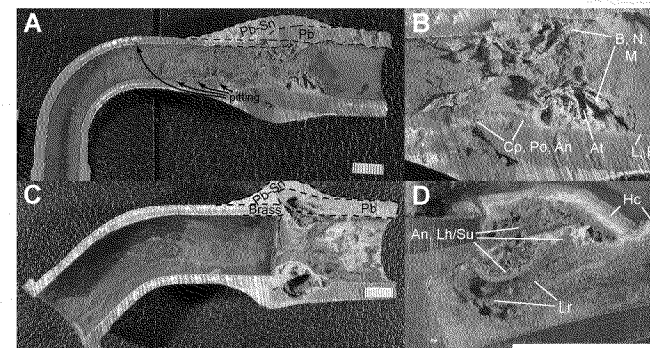
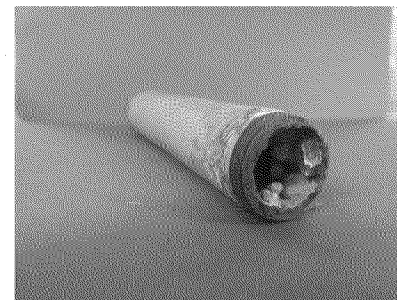
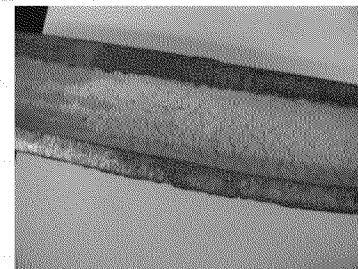
DS = A Long Longitudinal Reactor





Types of Corrosion of Concern

- **Uniform corrosion**
 - Materials degradation
 - Metal release (Pb, Cu, etc.)
- **Non-uniform corrosion**
 - Pinhole leaks (copper)
 - Dezincification
 - Tuberculation (iron, galvanized steel, brass)
- **Galvanic**
 - Soldered joints
 - Brass devices
 - Coupling of different pipe materials





Factors Governing Lead Levels

- Sampling protocol
- Intrinsic Pb solubility of surface material (water chemistry)
- Rate of dissolution in short stagnation times
 - Galvanic driving force (different metals, brass, solder)
 - Diffusion from surface (reaches steady state)
- Length of contact with lead source
- Nature of lead release
 - Particulate
 - Soluble

Additional point: There are no “corrosion indices” or surrogate pipe rigs that can take the place of directly monitoring lead release.

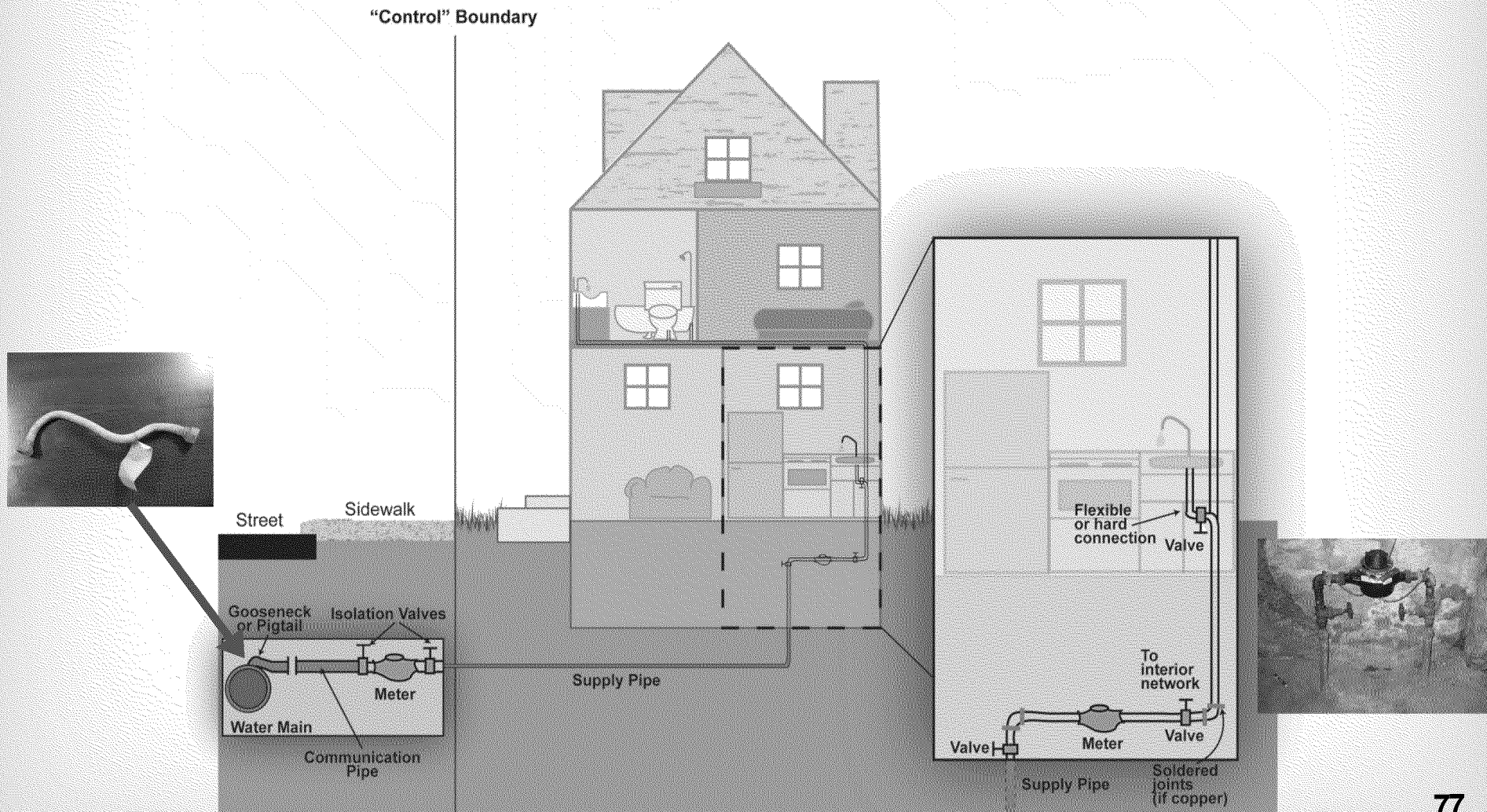


Many Places to Find Lead in Household Plumbing





Typical Household Pb Sources





“Ownership/Control” Situation 1

Scenario 1:

Only the portion of the service line from the water main to the external shut-off valve or property line is made of lead.

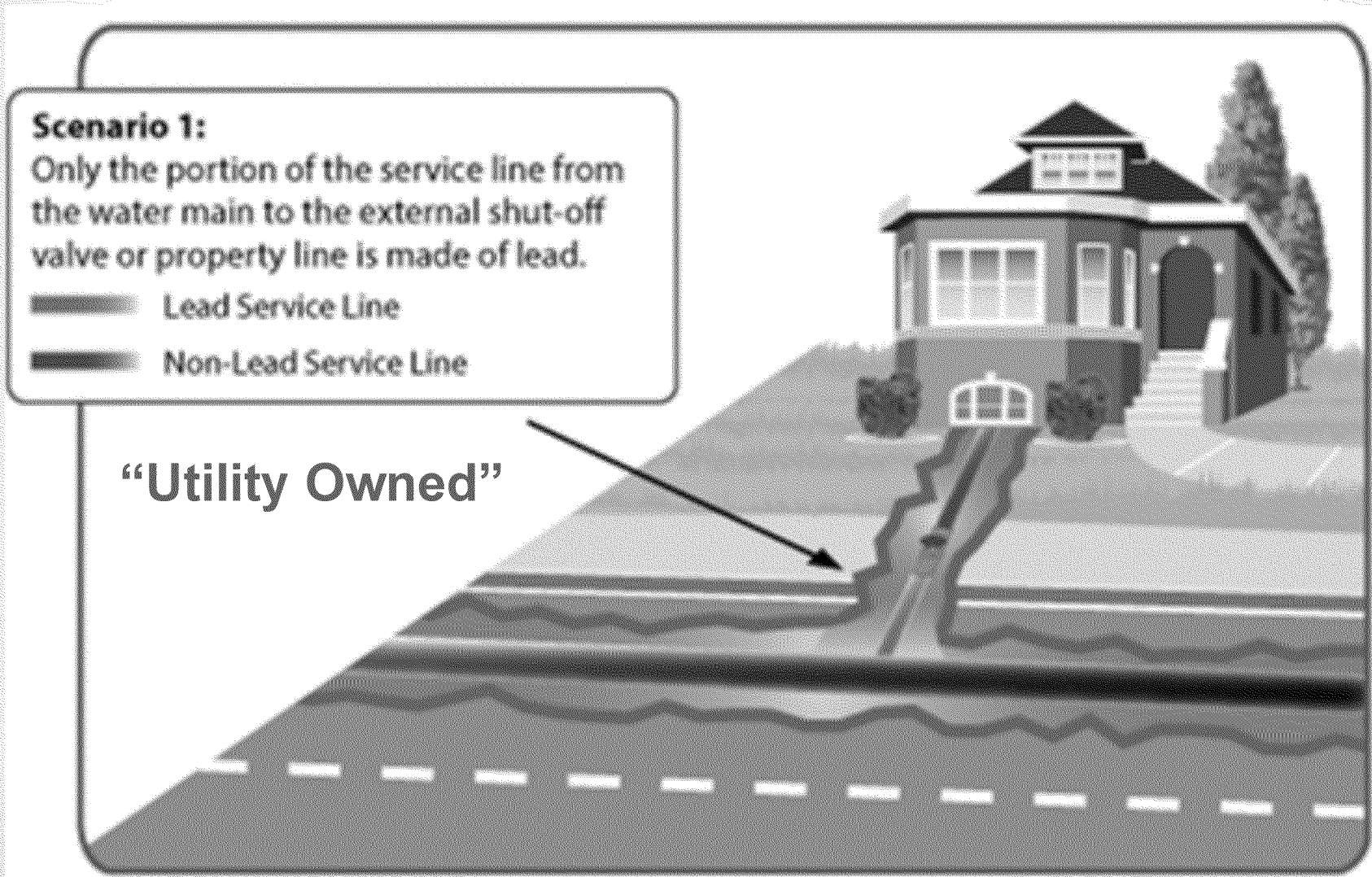
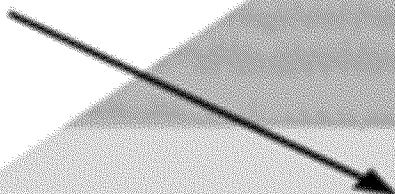


Lead Service Line



Non-Lead Service Line

“Utility Owned”





“Ownership/Control” Situation 2

Scenario 2:

Only the portion of the service line from the external shut-off valve or property line to the interior plumbing is made of lead.



Lead Service Line



Non-Lead Service Line

“Property Owner
Owned”





“Ownership/Control” Situation 3

Scenario 3:

The entire service line is made of lead from the water main to the interior plumbing.

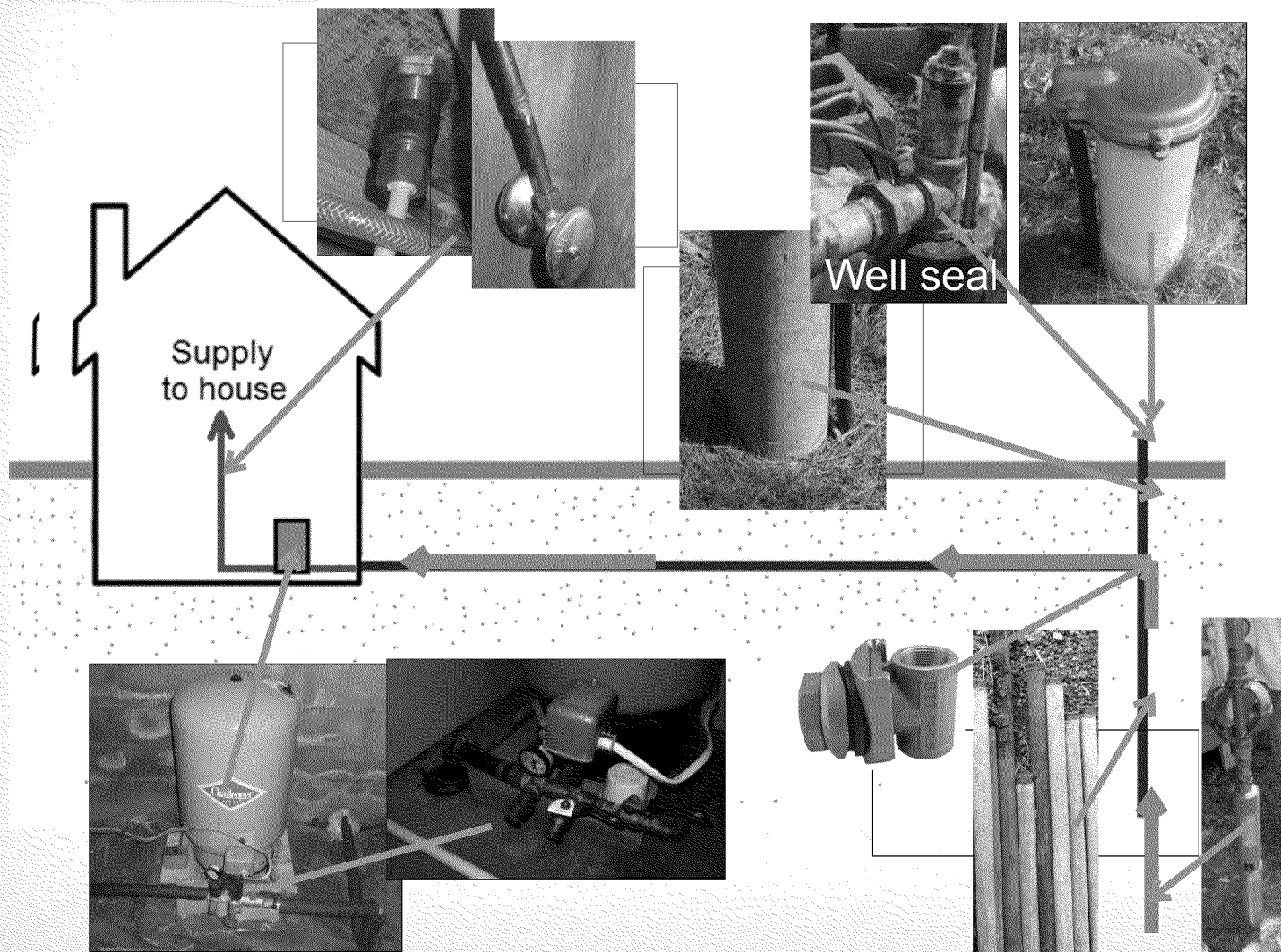
 Lead Service Line

“Mixed Ownership”
= Shared
Responsibility

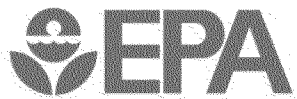
A cross-sectional diagram of a residential property. A house is shown on a hill. A service line runs from the water main in the street, through the yard, and into the house. The entire service line is highlighted in a darker shade, indicating it is made of lead. Two arrows point from the text "Mixed Ownership" to the service line, one in the street and one in the yard, indicating shared responsibility.



Private Water System Pb Sources



Courtesy: Kelsey Pieper, UNC



Main Connection through Curb Stop





Two Problems at Once: Galvanic Corrosion and LSL Disturbance!!

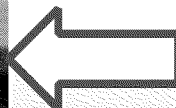




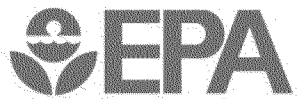
Examples of Service Line Replacement



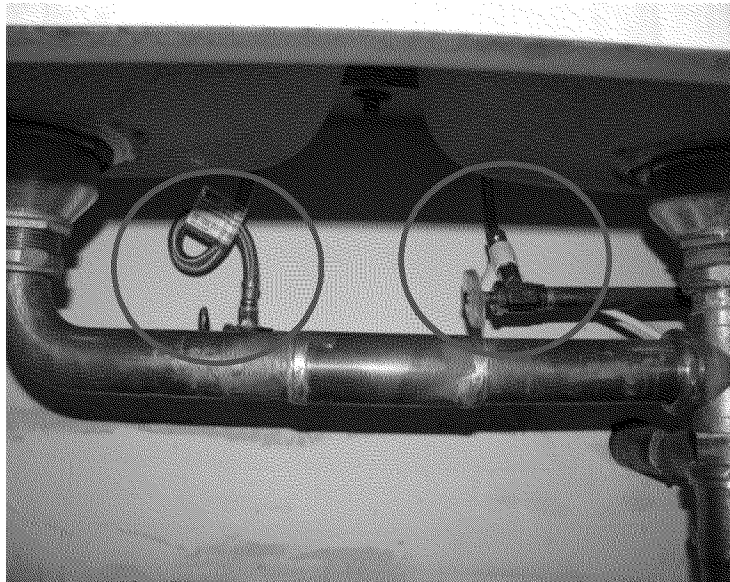
Copper replacing steel



Lead (before replacement)



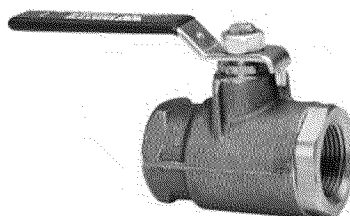
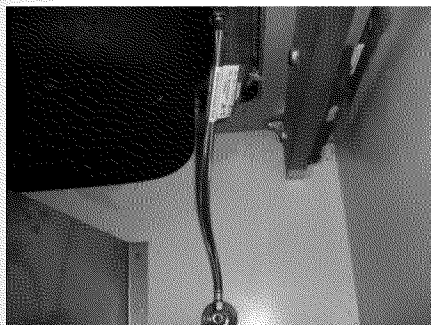
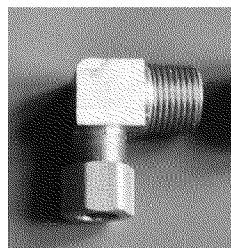
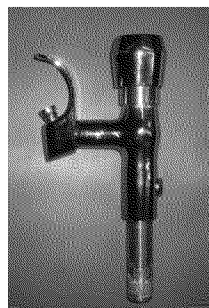
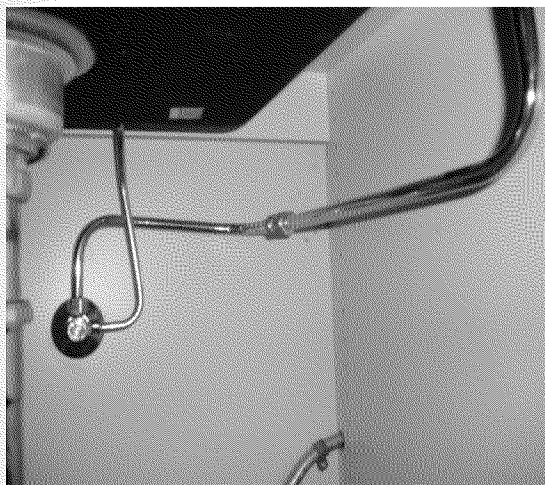
Valves Often Are Overlooked When Focus is on Faucets



- Shut-off valves frequently captured in 250 mL to 1 L samples
- Often not certified ANSI/NSF Section 9



Lead Sources Are Often Hidden





Characteristics of Pb Sources

- When present, LSL is biggest reservoir of Pb, but may not always be highest spike or peak value
 - Dislodged particles
 - PbO₂-LSL scale systems may have higher Pb from brass fixtures and fittings
- Pb sources within housing and buildings
 - Numerous hidden locations (behind walls, under floors, etc.)
 - Small lateral extent in each occurrence
 - May be located considerably distance from consumption tap
- Sampling instruction details matter
 - Random use pattern presumed by LCR
 - Pre-flushing all but eliminates detecting LSL contribution
 - Water use *prohibited from tap* is different from
 - Water use *prohibited from house/feed line*



Accidental or Intentional Treatment to Immobilize Lead Release

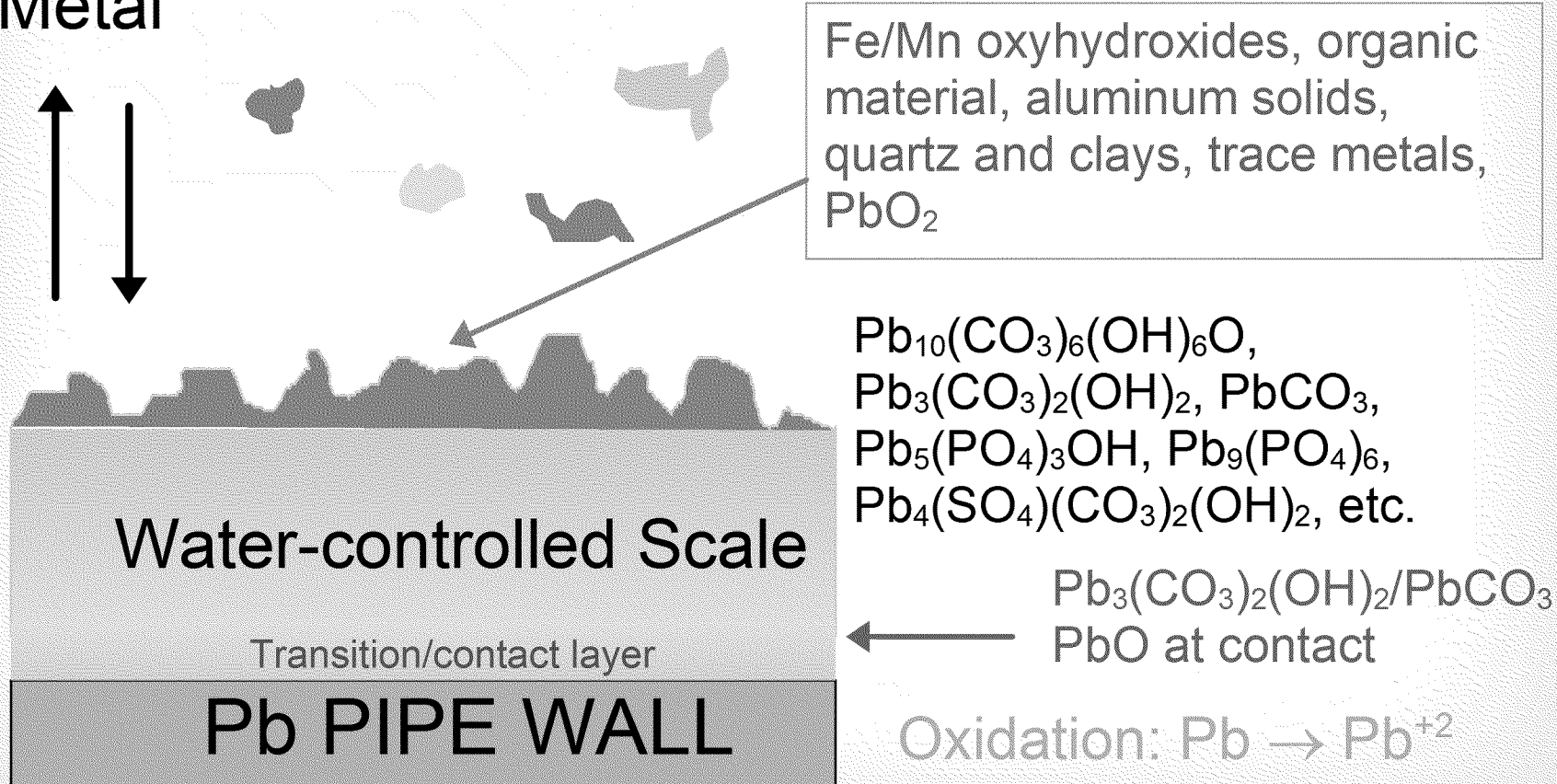




Typical Pb(II) Scale X-section

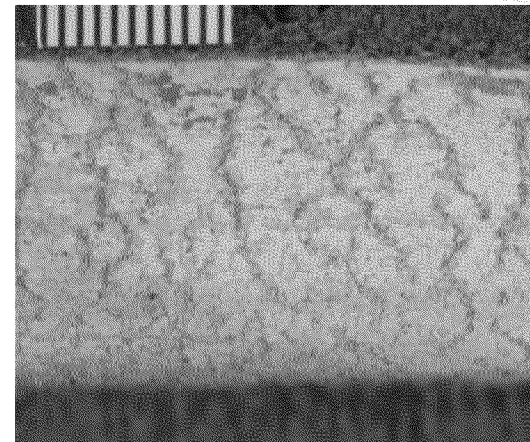
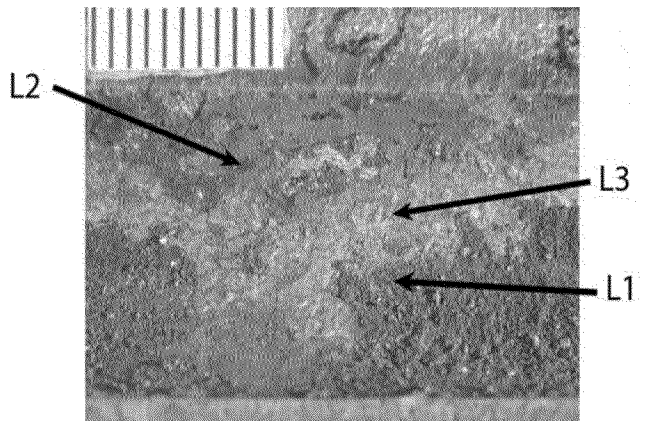
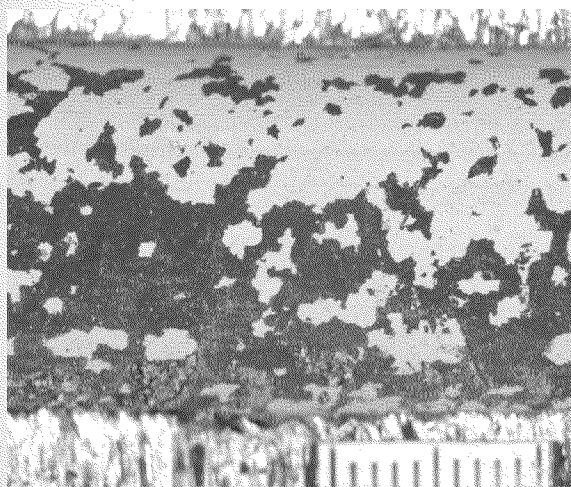
Soluble
Metal

(Exaggerated vertical scale!)





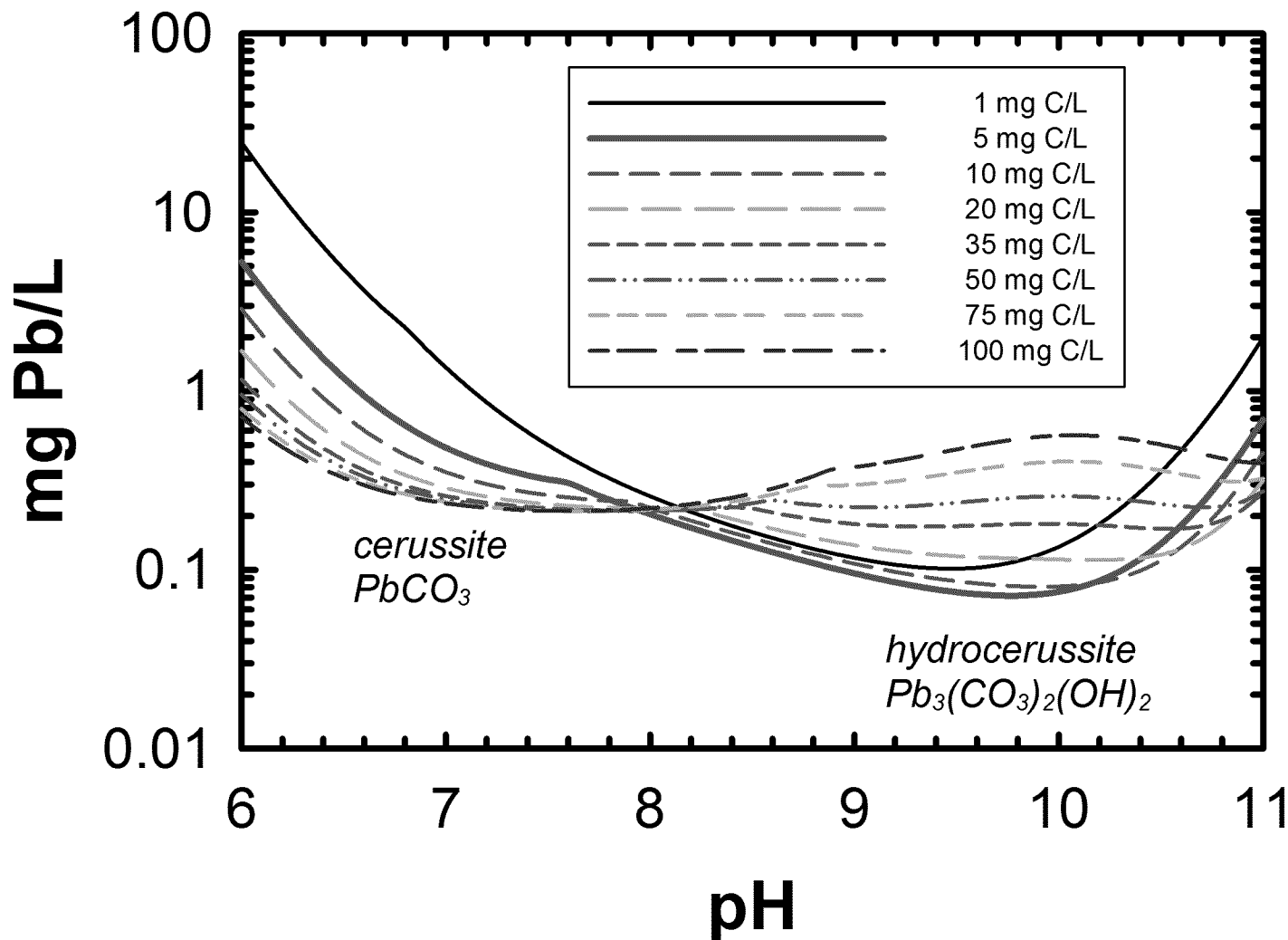
Only some LSL scales are simple

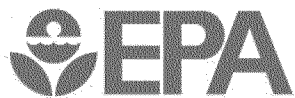




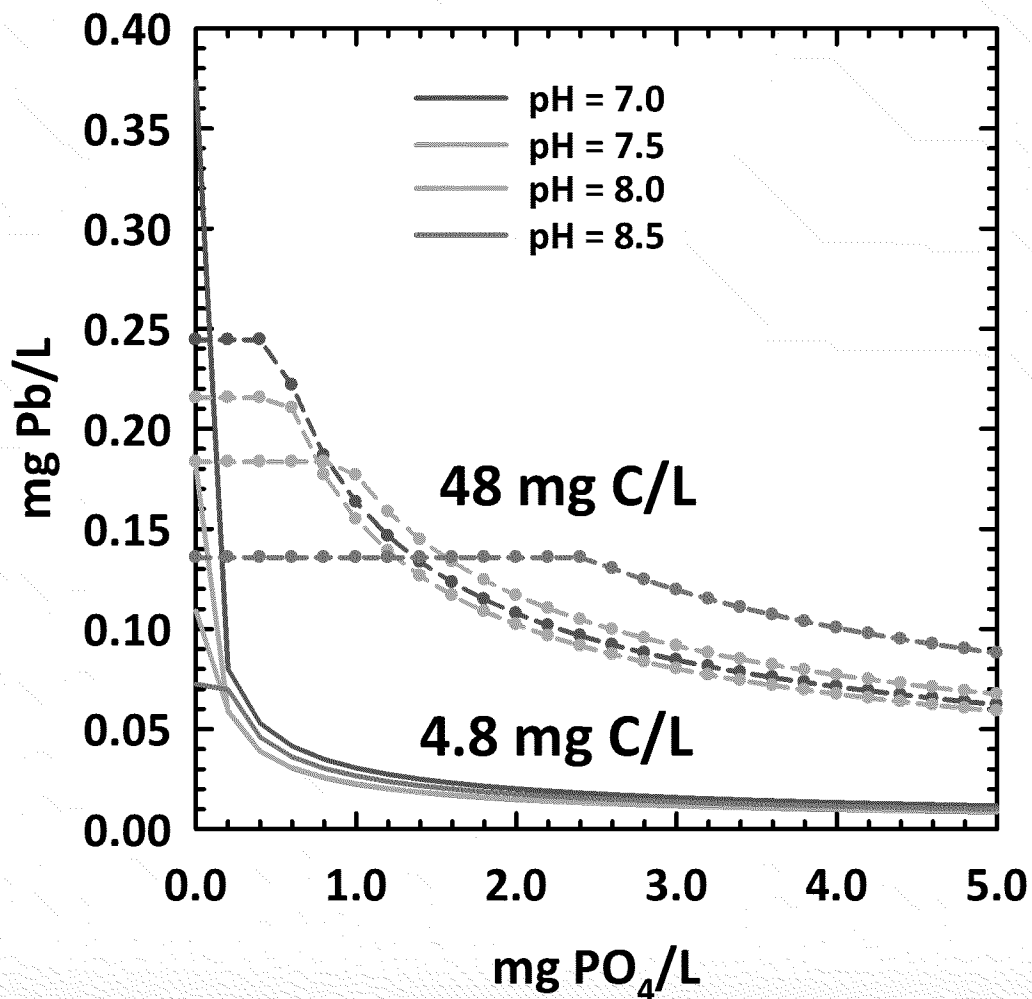
Effect of DIC and pH on Pb(II) Soly.

$$\text{DIC} = [\text{H}_2\text{CO}_3^*] + [\text{HCO}_3^-] + [\text{CO}_3^{2-}]$$



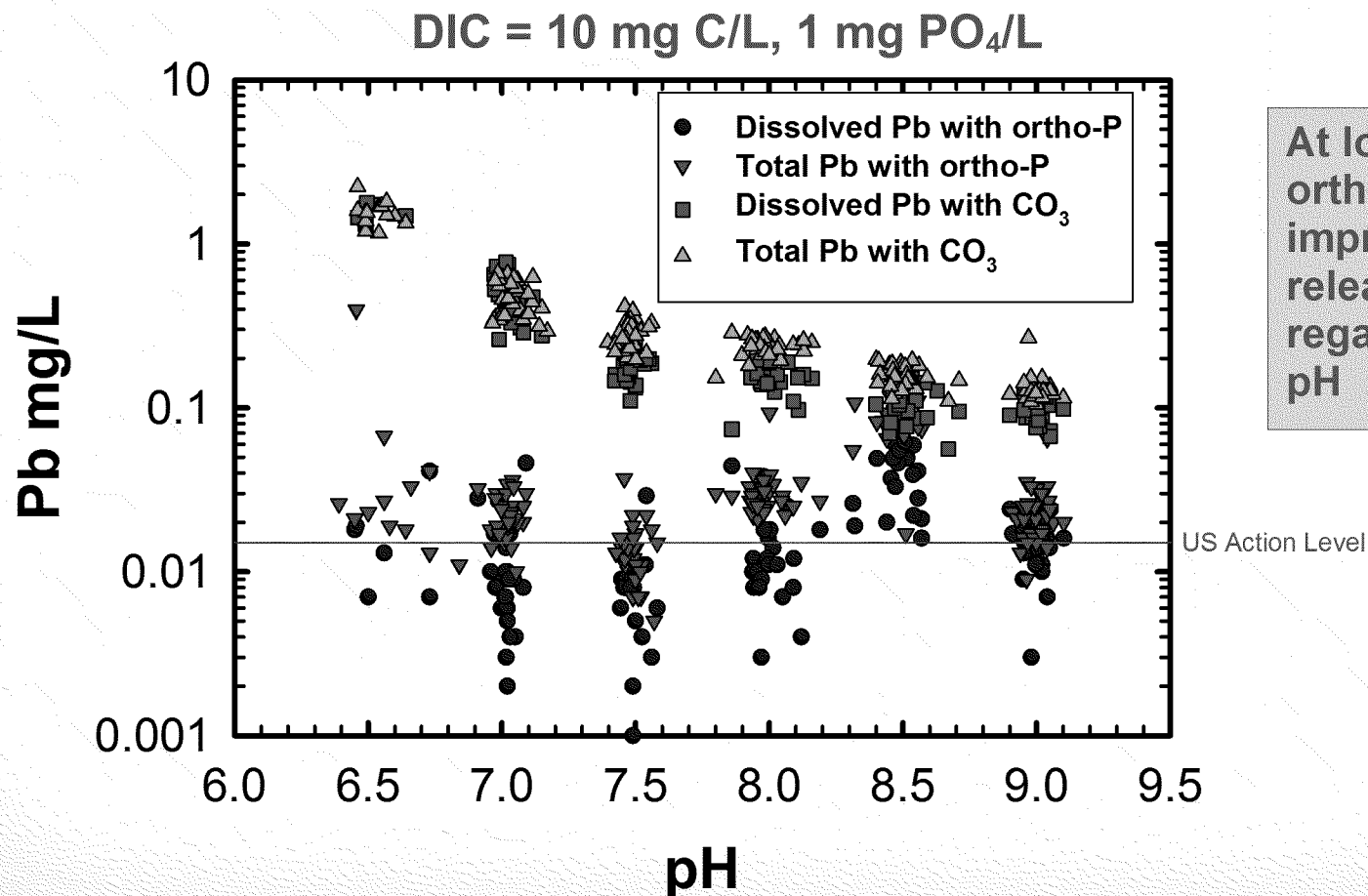


Pb(II) Solubility is Reduced by Orthophosphate (also with soils)





Effect of pH and PO_4 on Pb Release



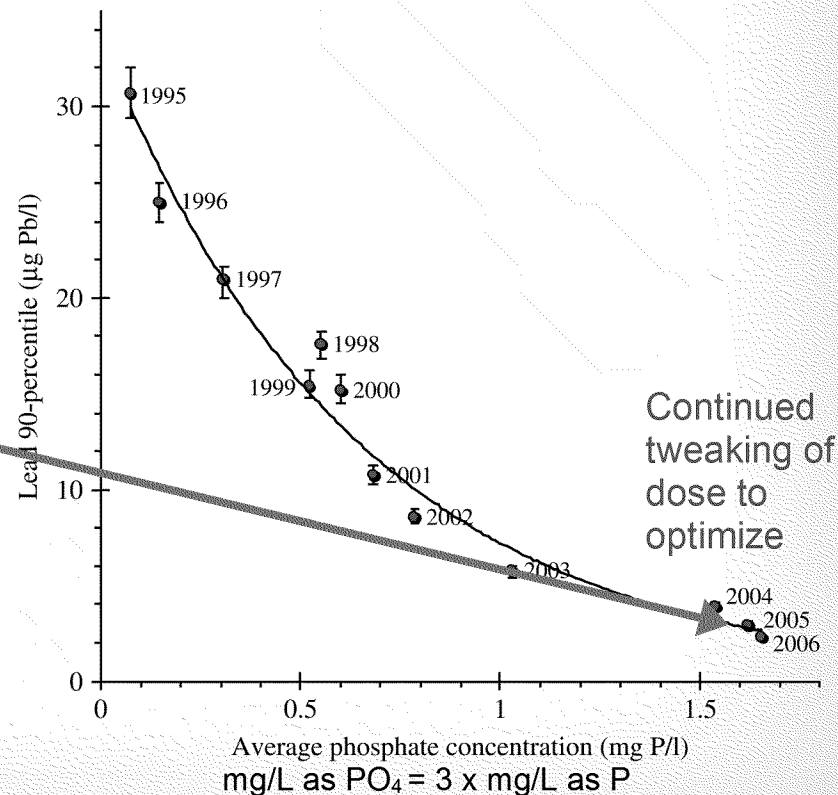
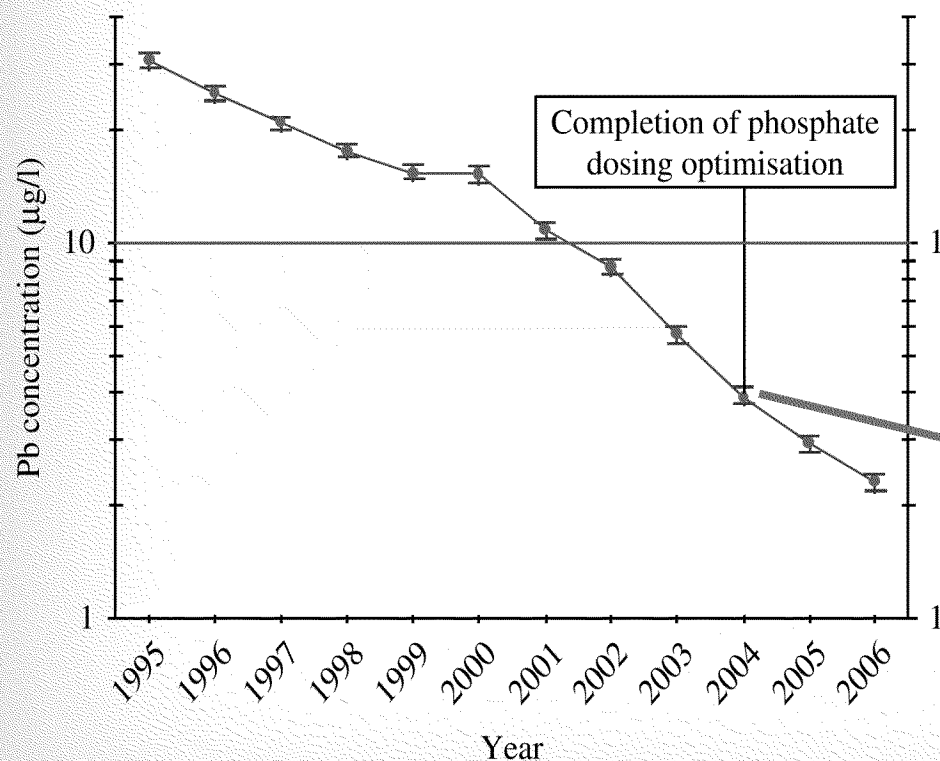
At low DIC,
orthophosphate
improves lead
release
regardless of
pH

Schock, M. R.; DeSantis, M. K.; Metz, D. H.; Welch, M. M.; Hyland, R. N.; Nadagouda, M. N. *Revisiting the pH Effect on the Orthophosphate Control of Plumbosolvency*, Proc. AWWA Annual Conference and Exposition, Atlanta, GA, **2008**.



Treatment Works on Both Soluble & Particulate Release

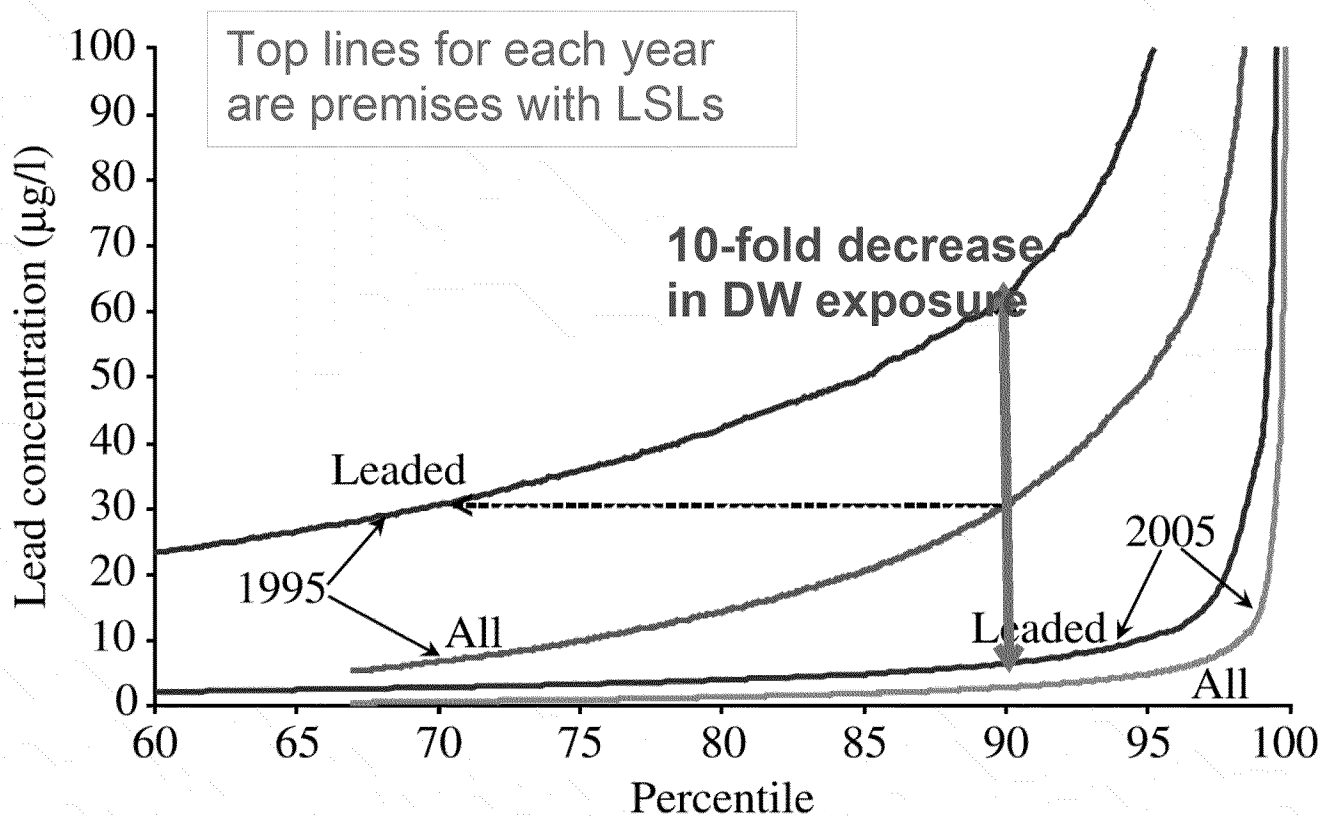
Aggregated UK Monitoring Data: Used two-pronged approach:
(1) Initial dose estimation by pipe rig study for background water
(2) RDT tap monitoring to assess progress & exposure



Cardew, P. T. Measuring the benefit of orthophosphate treatment on lead in drinking water. *J Water Health* 2009, 7 (1), 123-31.



UK Decade of Pb Optimization Progress for Both LSLs and Other Pb Sources



Cardew, P. T. Measuring the benefit of orthophosphate treatment on lead in drinking water. *J Water Health* **2009**, 7 (1), 123-31.



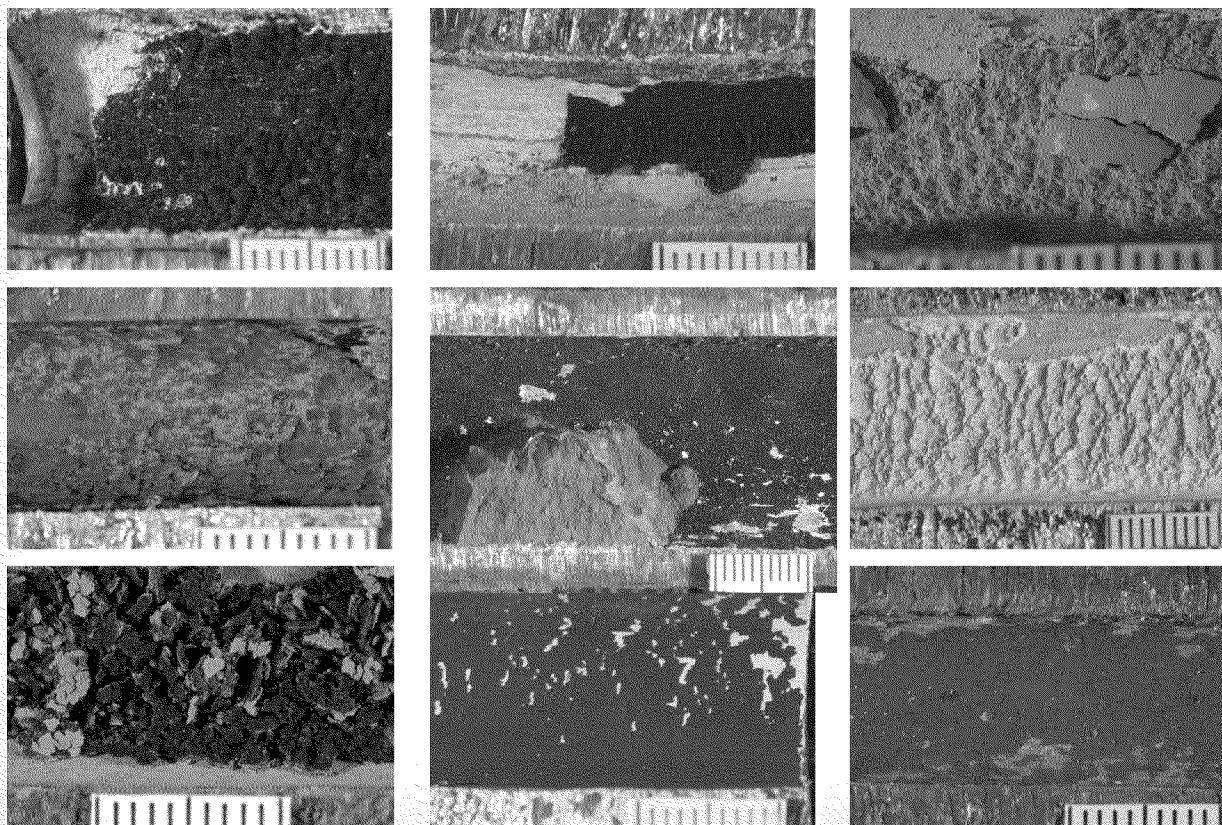
There Are Many Types of Scale on Pb Pipe

- Simple carbonate or hydroxycarbonate Pb(II) mineral
- Simple Pb(II) orthophosphate mineral
- Simple PbO₂ solid phase, by itself or mixed with Pb(II) phases
- Mix of Pb(II) phases
- Protective “diffusion barrier” materials
 - Could be insoluble amorphous Pb(II) phase
 - Adherent non-Pb phase
- Surface fouling deposit
 - Primarily not made of lead, usually not crystalline
 - Lead may sorb to surface
 - Often not adherent



Many LSL Scales Are Mixtures of Solids

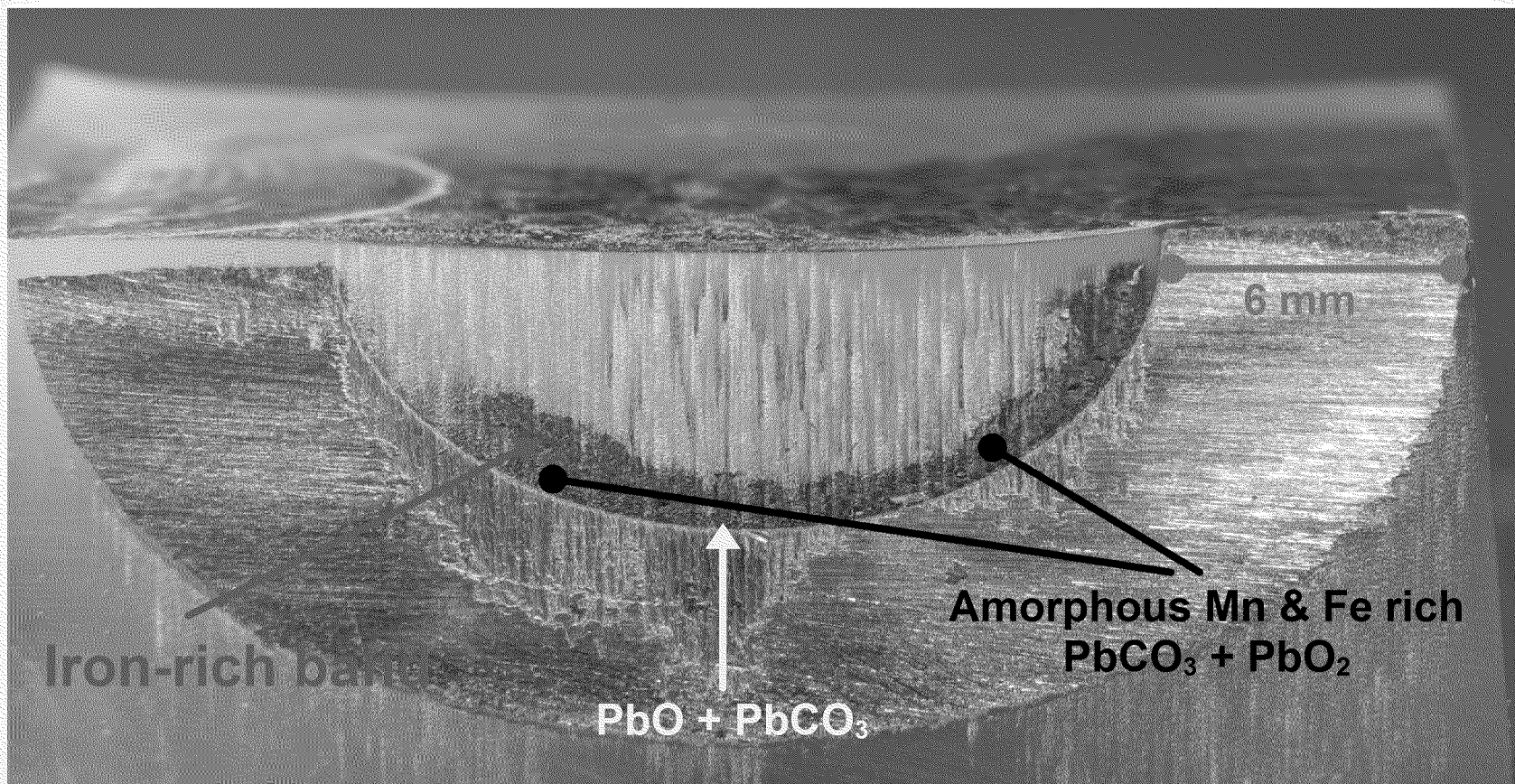
18 of 52 DWDS studied by EPA show external layer deposits almost completely made of poorly crystalline Mn, Fe, Al, Ca, or Si-rich phases



Adding orthophosphate or just adjusting pH with thick coatings likely will not minimize lead release until causes of the interfering buildups are controlled

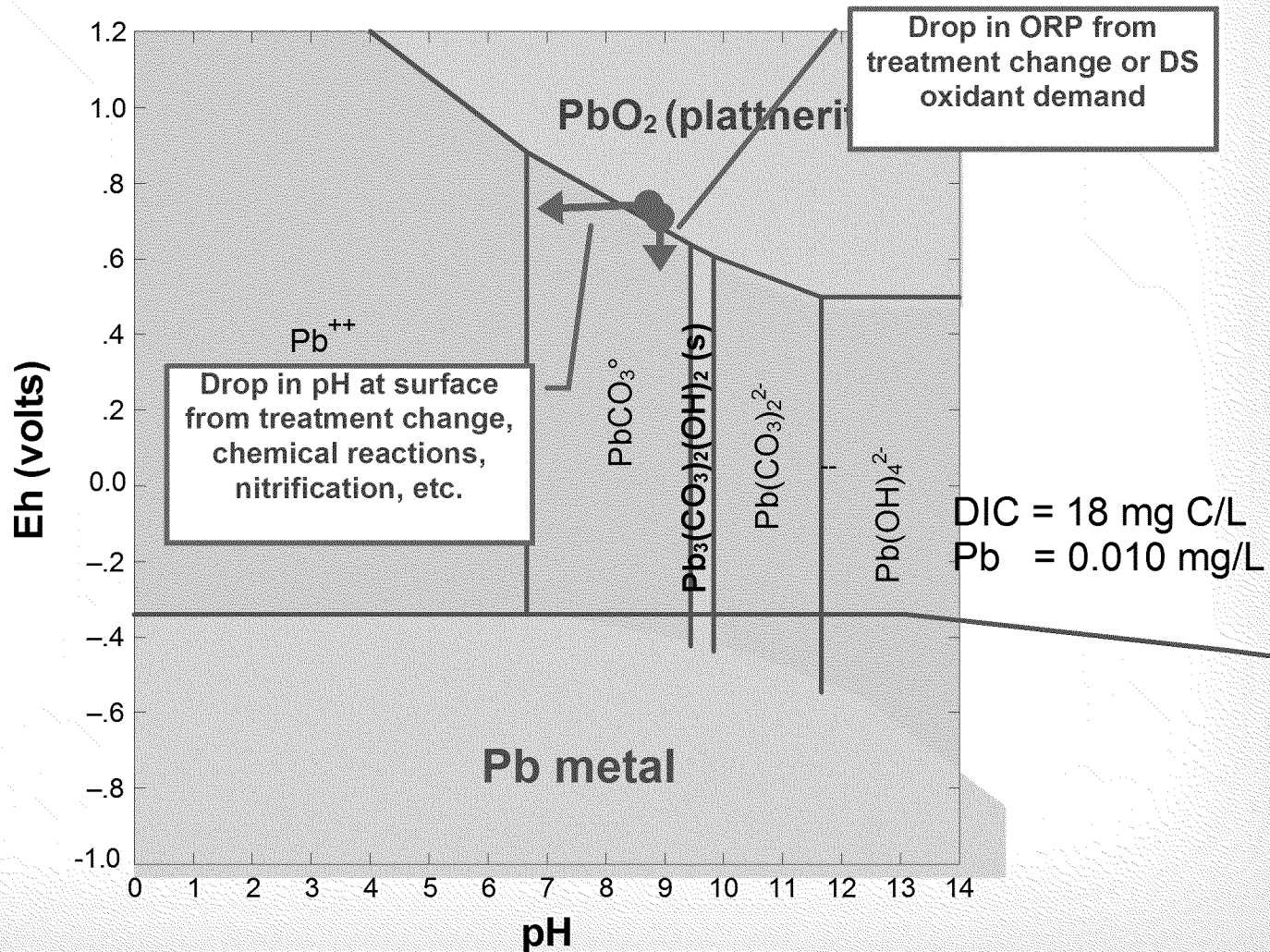


Layering from ORP-Induced Deposition





Protective PbO_2 May Form at High ORP



Disinfectant demand in DS must be controlled and enough free chlorine consistently maintained throughout LSL area

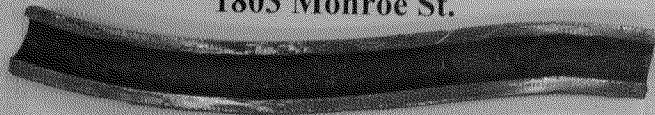


Examples of Protective PbO_2 Scales

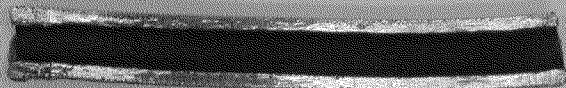
WASHINGTON, DC
Lead Service Line (c. 1926/8-2004)



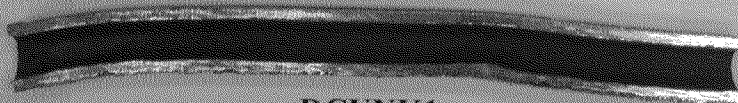
1803 Monroe St.



1335 Hemlock St. NW



1340 Hemlock St. NW



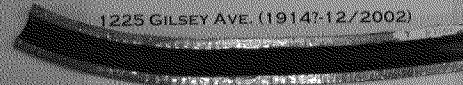
DCUNK1

Oakwood, Ohio
Lead Service Lines (rem. 2002)



CINCINNATI, OH
LEAD SERVICE LINE

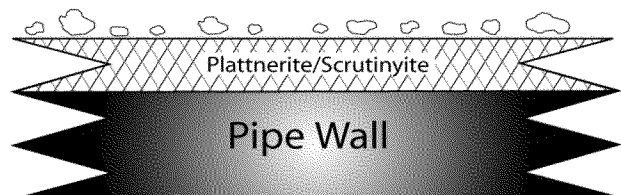
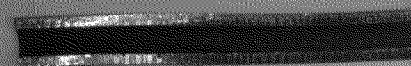
1225 GILSEY AVE. (1914?-12/2002)



119 CATALPA RD. (1925?-1/24/03)

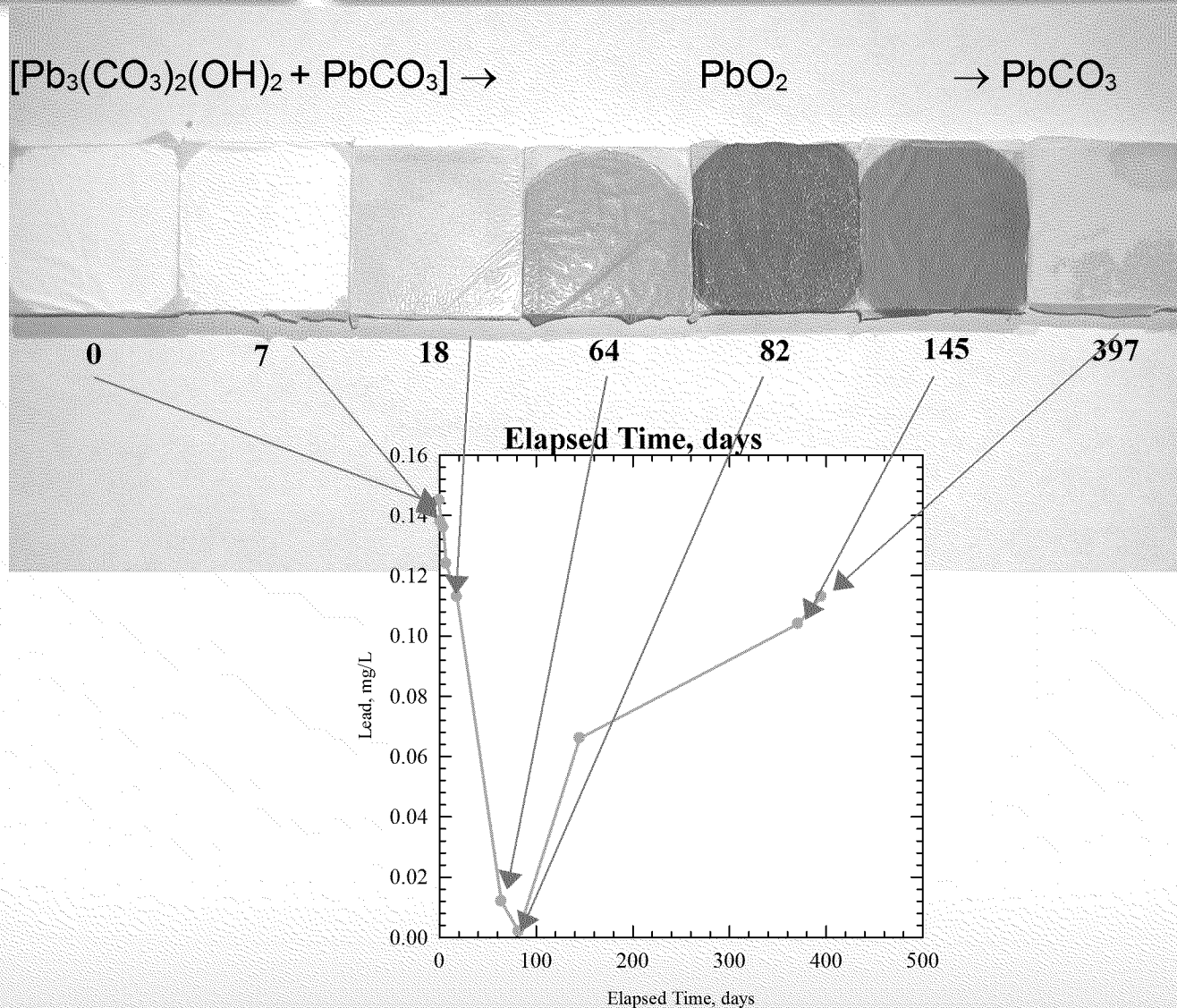


3030 JUNIETTA AVE. (1930?-1/24/03)



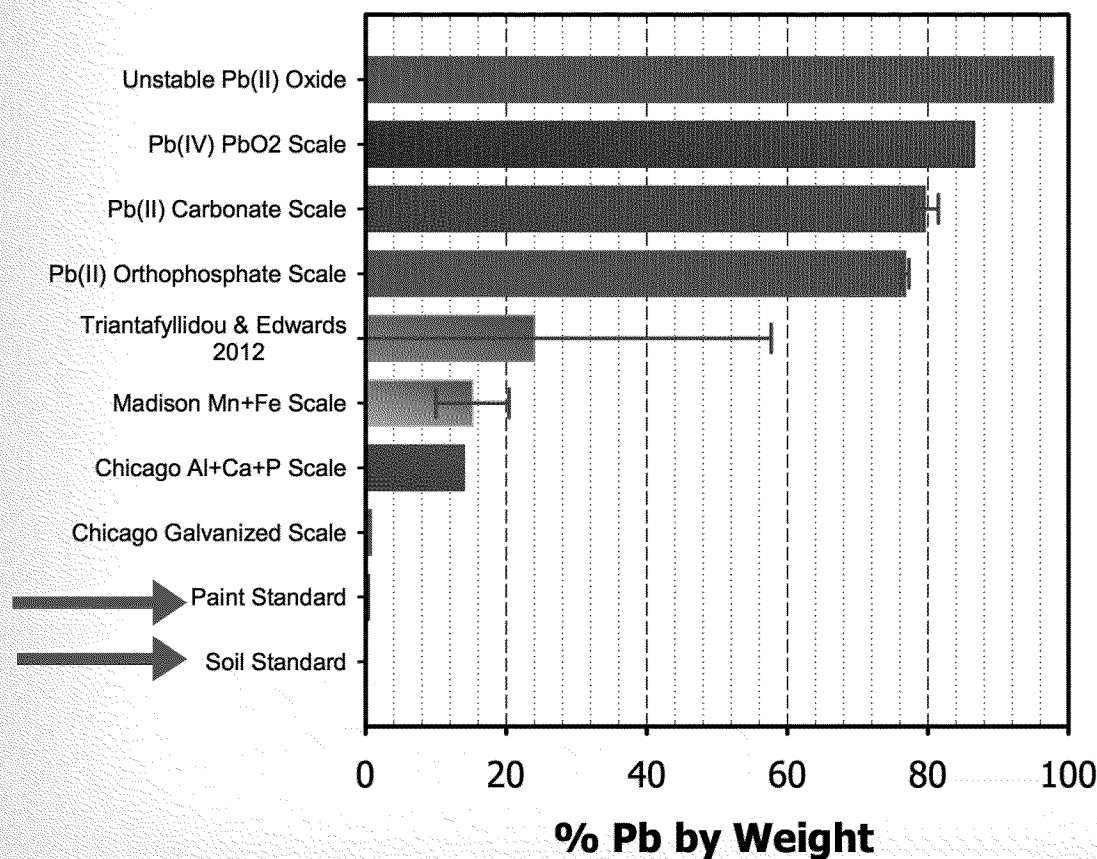


PbO₂ Scales Can Deteriorate if ORP Drops





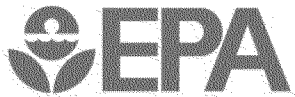
Drinking through Lead-Painted Pipes



Pipe scale particles have as much or more lead than Pb in paint or soil and is absorbed into food and concentrated, as well as directly ingested from water or beverages

Erosion and suspension of particles from pipe corrosion scales and deposits is inevitable.

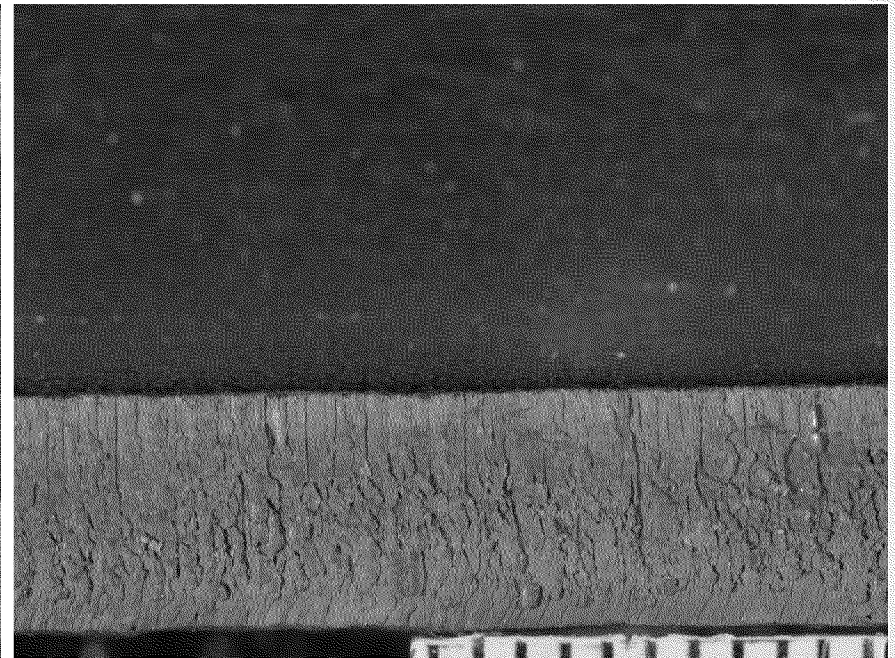
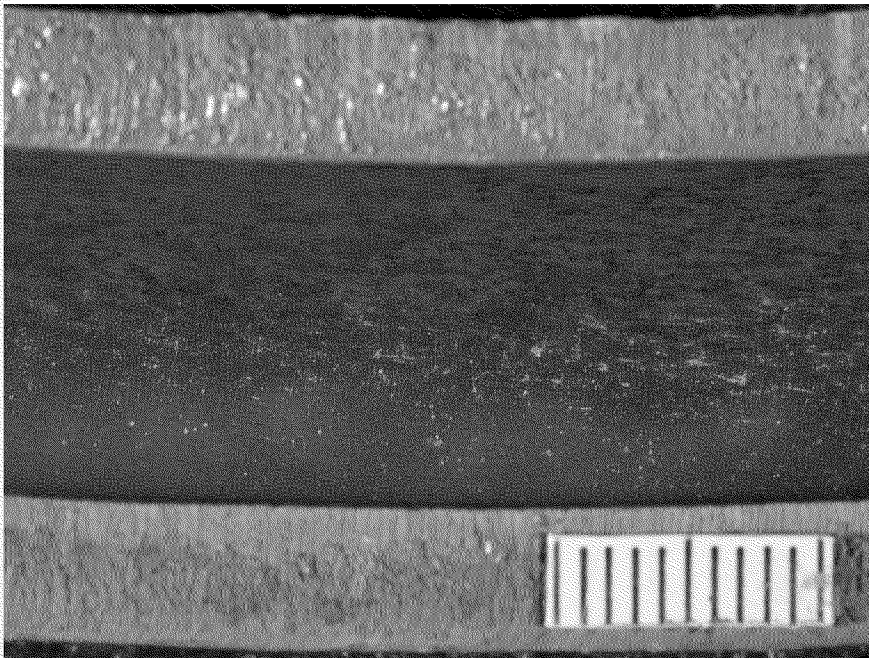
Even minute amounts are greater relative exposure than paint or soils



Lead Pipes Are Forever.... (Need to Be Removed)

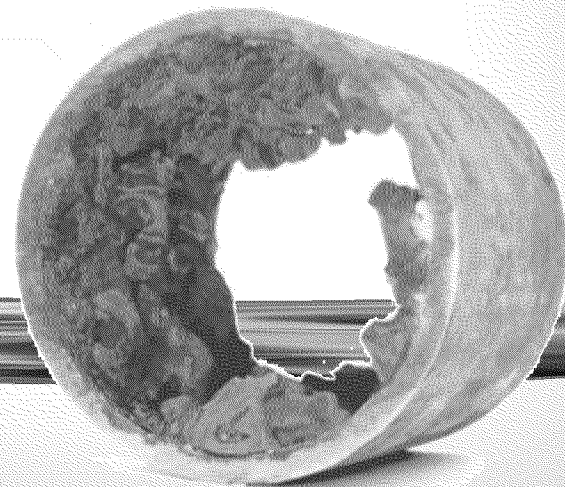
Lead Pipes Won't Go Away Any Time Soon

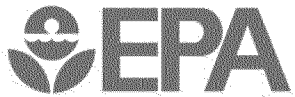
Installed Right After the Civil War 150 Years Old in Cincinnati: Any Signs of Failure?





The “Lead and Copper Rule” (LCR)





LCR Basic Framework: PWS ONLY

- 90th percentile Action Level IS NOT A HEALTH-BASED NUMBER
- Number is based on 1990 state of the art estimate of treatment “feasibility,” adjusted for system size
- Large systems required to “*minimize*,” not just meet AL
- AL triggers actions
 - More monitoring
 - Public Education
 - Treatment studies/implementation if not already doing so
 - Utility-owned lead service line replacement
- No violations attached to high Pb levels
- Violation/compliance mechanism is only monitoring and maintenance of “Optimal Water Quality Parameters”



Problems with OWQPs

- They were never set for most systems
- They are not a precise surrogate for lead release
 - Many interacting chemical & physical variables
 - Large fraction of systems aren't protected by simple Pb mineral scales
 - No theoretical basis for defining or setting parameters when scales are amorphous material of indefinite composition
- States set meaningless ranges that may not relate to Pb release
 - DC: phosphate range: 0.5-5 mg/L, pH over 7.2 in system
 - Houston: pH 7.6-8.6; alkalinity "over 20)

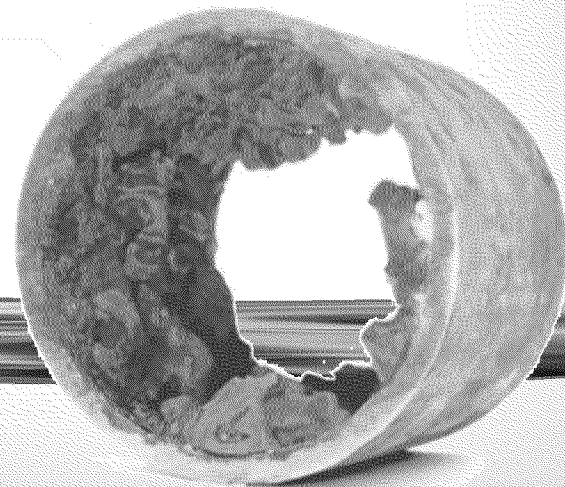


Sampling that Misses LSL Release

- Full preflushing before stagnation period
 - NOT intended by LCR, which relies upon random starting point across a community to be sure that LSC contributions in corrosive waters are captured in 1st draw, 1st liter
 - Some systems have LSLs but plastic interior pipes, particularly misleading when coupled with pre-flush
 - Recall that LCR sample typically represents first 10-20 ft behind tap
- Suggest samples be taken as close as possible to 6 hours stagnation
- Select high water use sites
- Avoid sampling from areas of DS where repair/rehabilitation is being done
- Select sampling sites from least corrosive water when DS is fed by multiple water qualities
- Do not check/verify proper age or type of site (LSL, Pb:Sn solder)



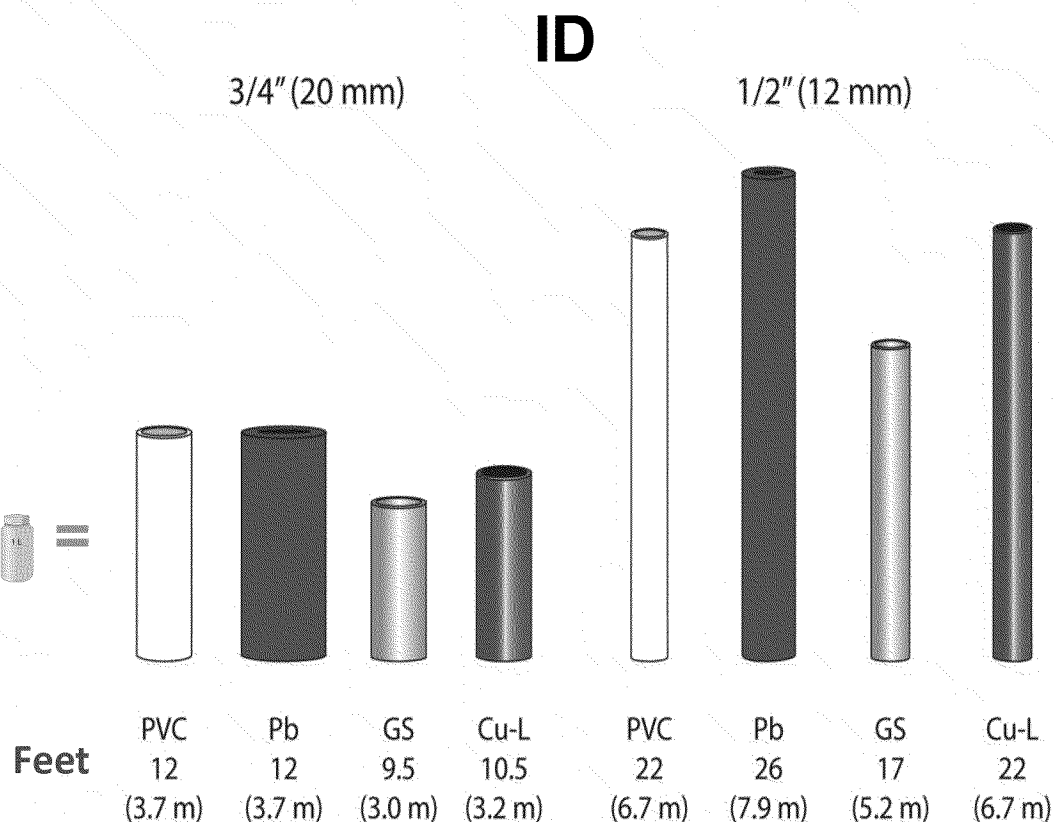
SAMPLING to Identify Lead Sources





Tool: Sample Volumes Represent Source Position in Plumbing

Wide-mouth bottles preferable to allow higher flow rate

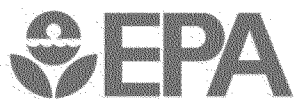


After: Schock, M. R.; Lytle, D. A. Internal Corrosion and Deposition Control; In *Water Quality and Treatment: A Handbook of Community Water Supplies*; Sixth ed. 2011.



Sample Volume Per Length: Cu

Material	Type	Nominal Size (in)	OD (in)	Thickness (in)	ID (in)	mL/ft	mL/m	ft per L	m per L
Copper tube	K	0.500	0.625	0.049	0.527	43	141	23.3	7.1
Copper tube	L	0.500	0.625	0.04	0.545	46	151	21.8	6.6
Copper tube	M	0.500	0.625	0.028	0.569	50	164	20.0	6.1
Copper tube	K	0.750	0.875	0.065	0.745	86	281	11.7	3.6
Copper tube	L	0.750	0.875	0.045	0.785	95	312	10.5	3.2
Copper tube	M	0.750	0.875	0.032	0.811	102	333	9.8	3.0
Copper tube	K	1.000	1.125	0.065	0.995	153	502	6.5	2.0
Copper tube	L	1.000	1.125	0.05	1.025	162	532	6.2	1.9
Copper tube	M	1.000	1.125	0.035	1.055	172	564	5.8	1.8

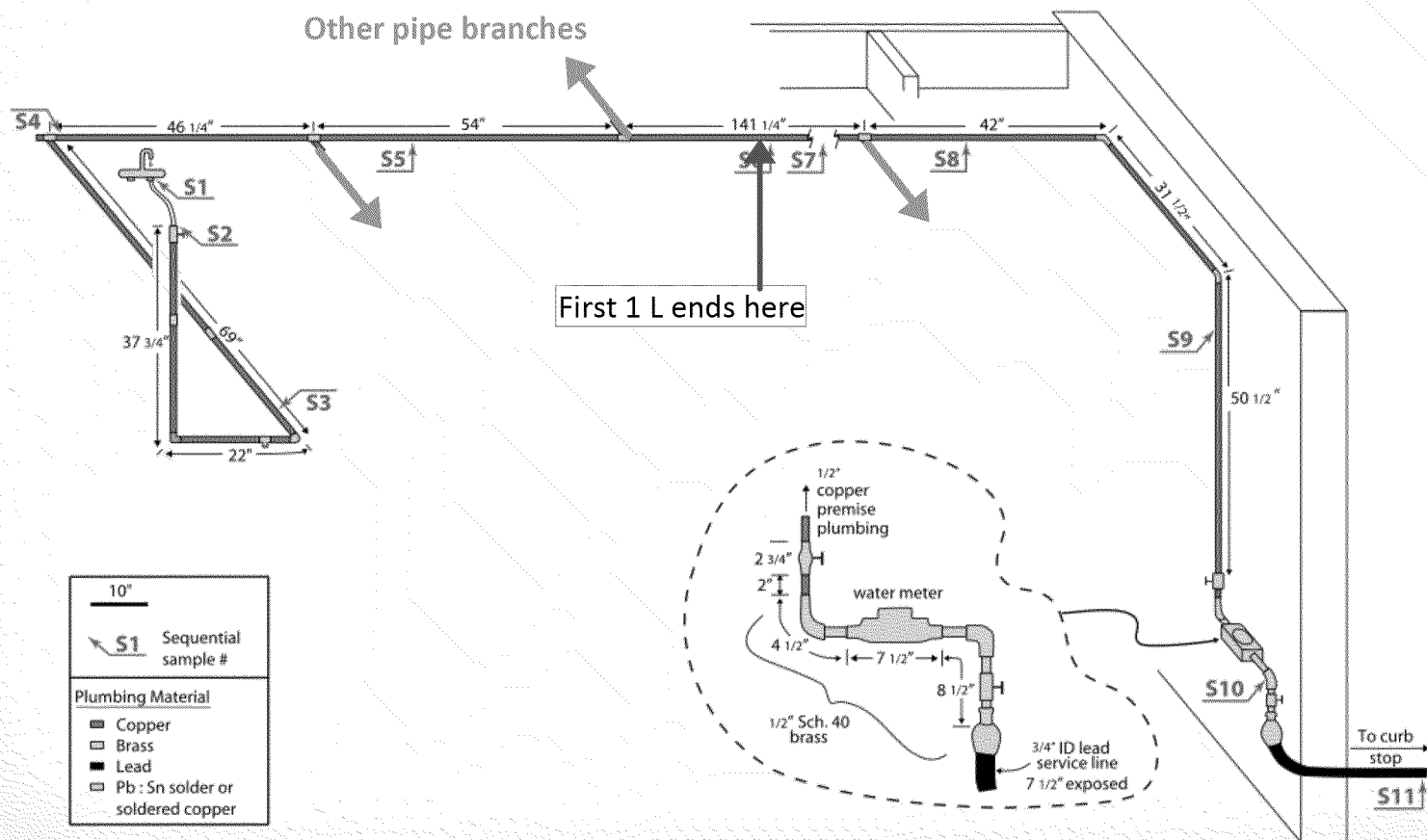


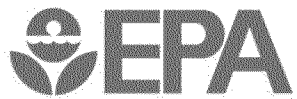
Sample Volume/Length (other)

Material	Type	Nominal Size (in)	OD (in)	Thickness (in)	ID (in)	mL/ft	mL/m	ft per L	m per L
Galvanized steel	Sched 40	0.500	0.840	0.109	0.622	60	196	16.7	5.1
Galvanized steel	Sched 40	0.750	1.050	0.113	0.824	105	344	9.5	2.9
Galvanized steel	Sched 40	1.000	1.315	0.133	1.049	170	558	5.9	1.8
Lead	0.25-in wall	0.500	1.000	0.25	0.500	39	127	25.9	7.9
Lead	0.25-in wall	0.625	1.125	0.25	0.625	60	198	16.6	5.1
Lead	0.25-in wall	0.750	1.250	0.25	0.750	87	285	11.5	3.5
PVC, CPVC	Sched 80	0.500	0.84	0.147	0.546	46	151	21.7	6.6
PVC, CPVC	Sched 80	0.75	1.05	0.154	0.742	85	279	11.8	3.6
PVC, CPVC	Sched 80	1	1.315	0.179	0.957	141	464	7.1	2.2
HDPE	200 psi	1	1.315	0.146	1.023	162	530	6.2	1.9

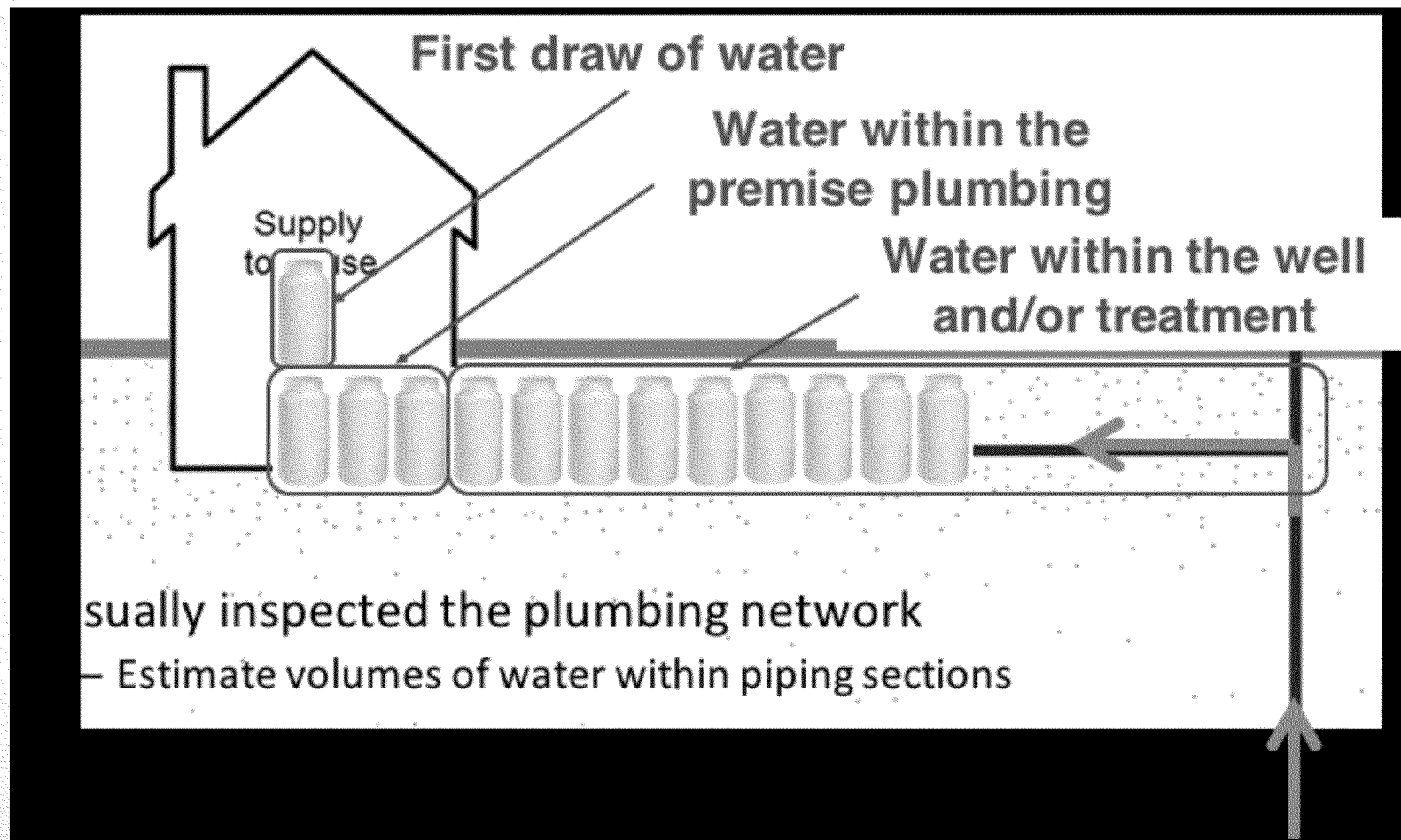


Identifying Pb Sources in a House: Volume as Distance





Concept of Sequential Sampling (aka “profiling”)

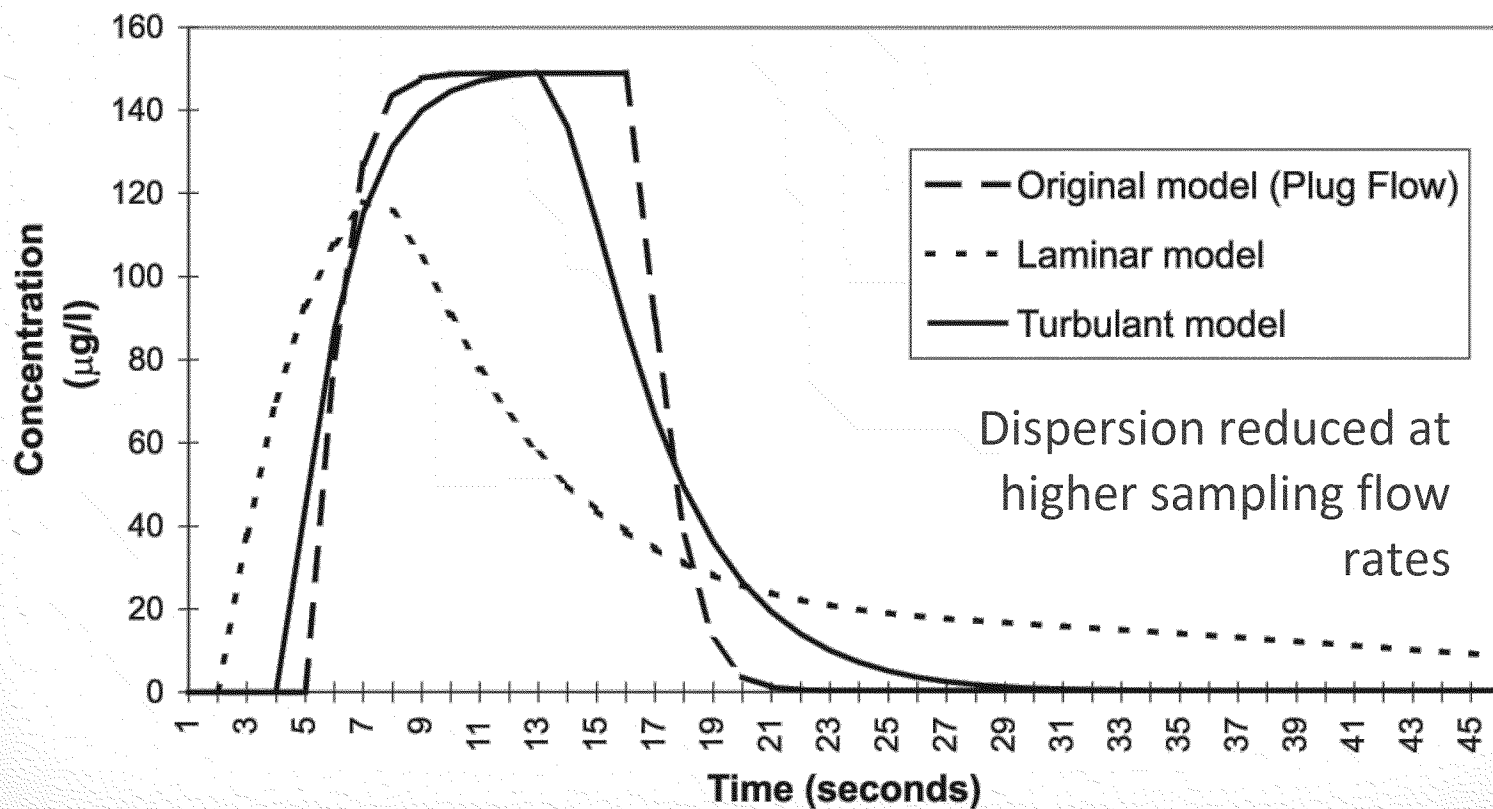


Courtesy: Kelsey Pieper, UNC

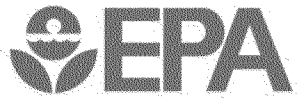


Resolution Depends on Dispersion

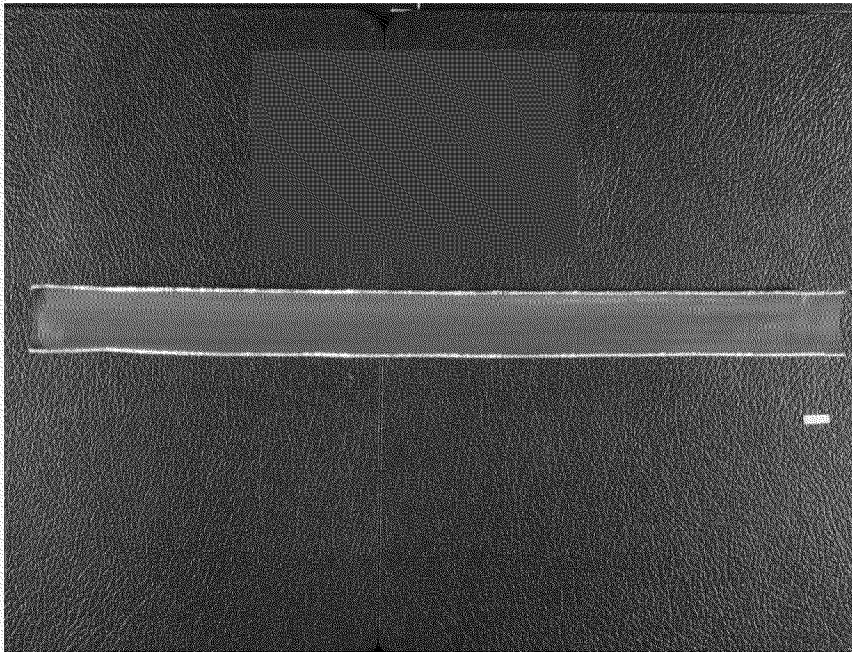
Average Concentration at Tap



From: VanDer Leer et. al. *Applied Mathematical Modelling*, (2002) 26:681–699

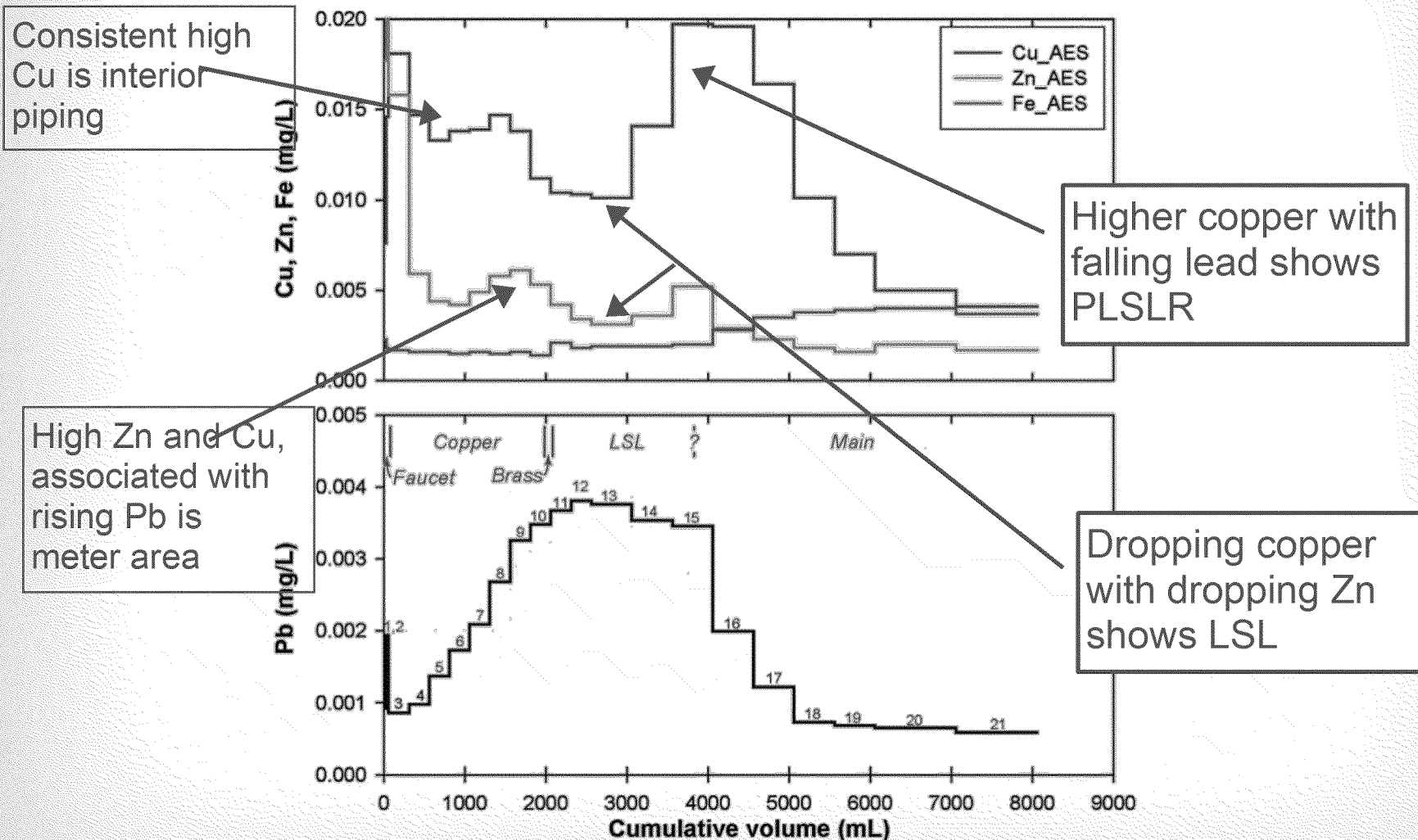


Tuberculation and Physi Characteristics Impact Fl





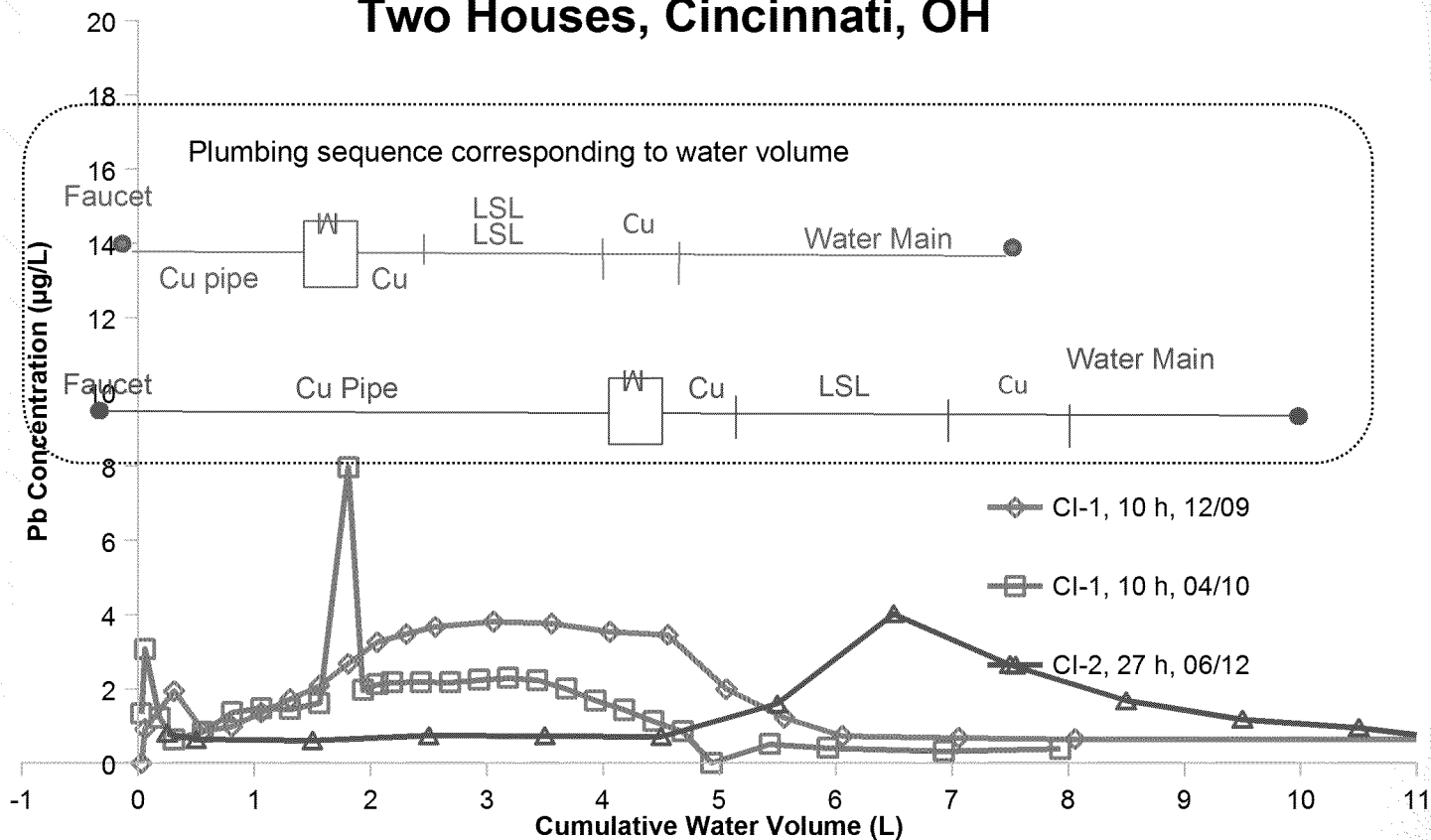
Including Cu, Zn and Fe is Very Useful





Example Profiles of PbO₂ Scale House

Two Houses, Cincinnati, OH

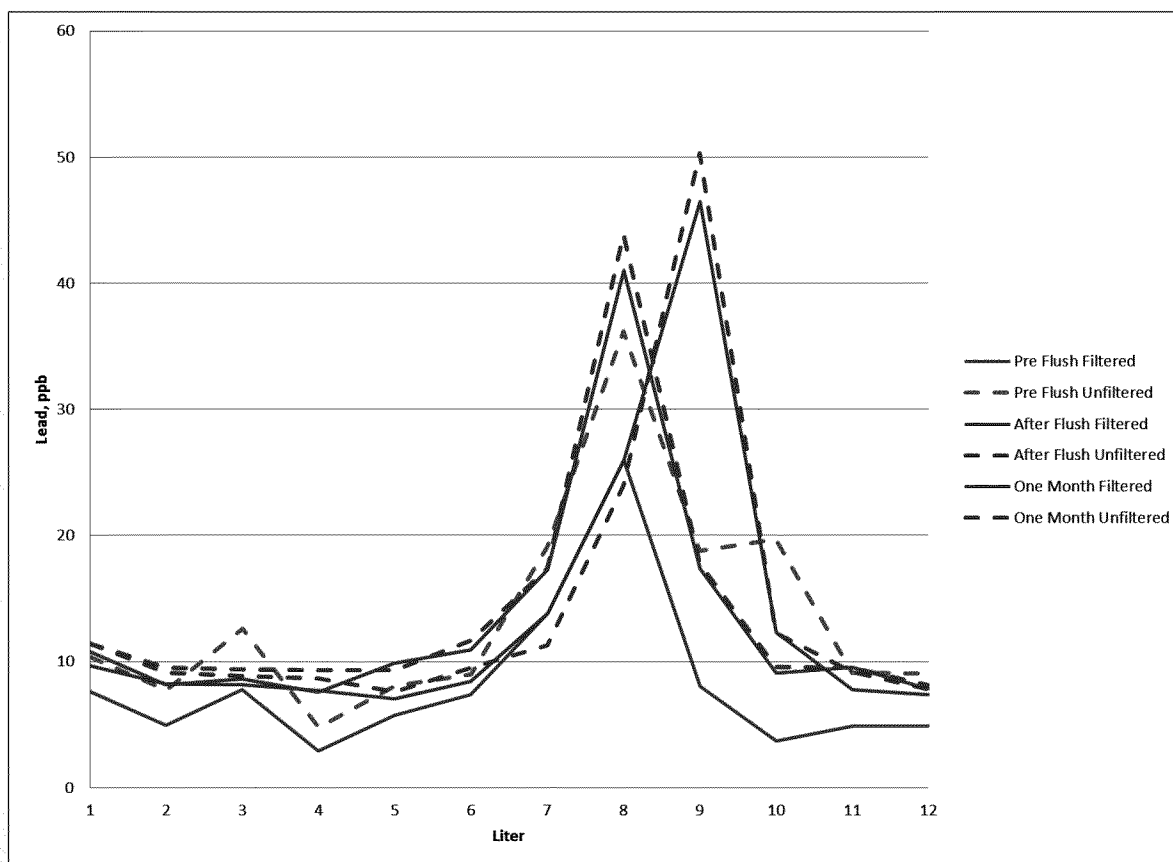


Peak lead at approximately 2.5 – 4 L, and approximately 6.5 L



Triplicate Profiles in a Different Area

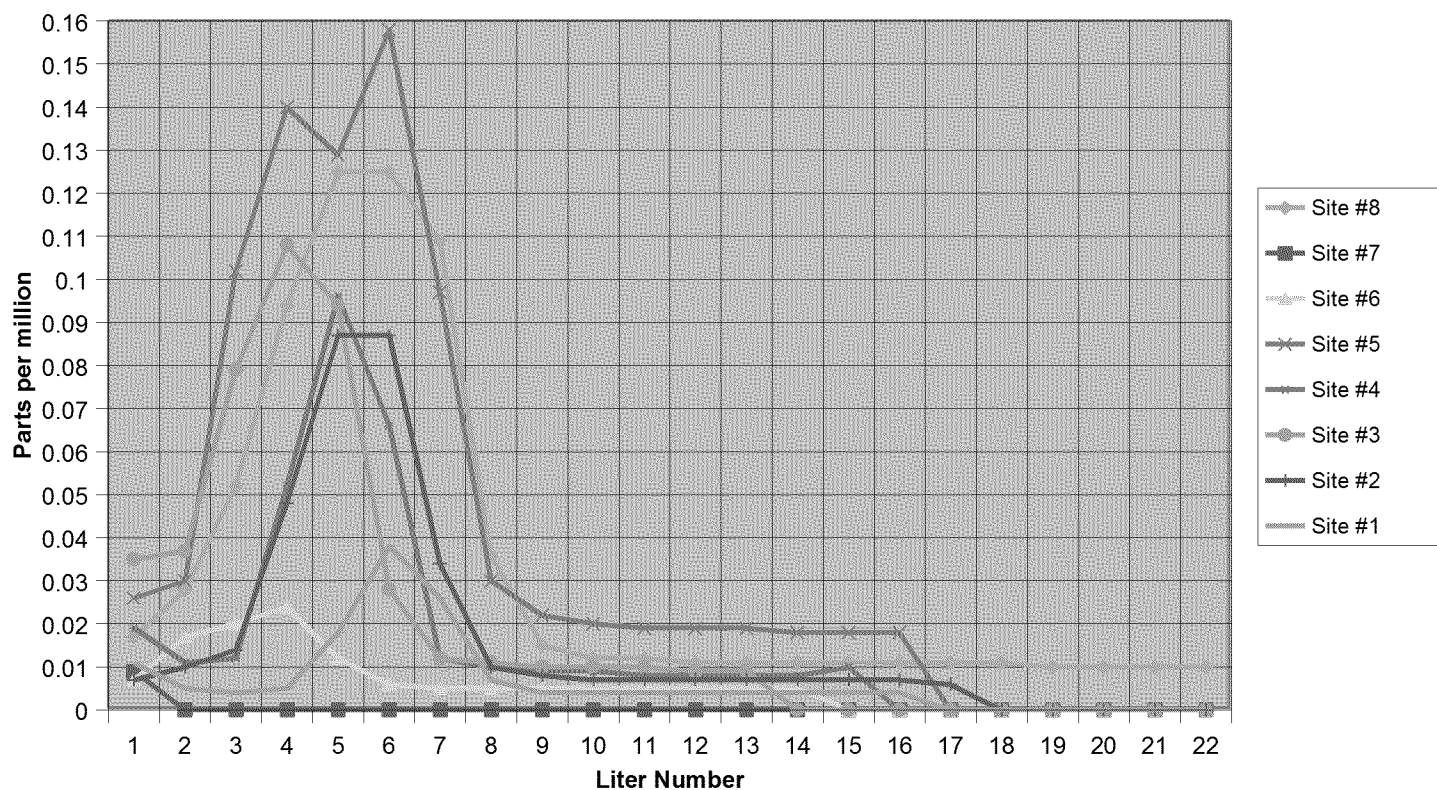
with no apparent difference in water age or water chemistry





LSL Profiles, Providence, RI

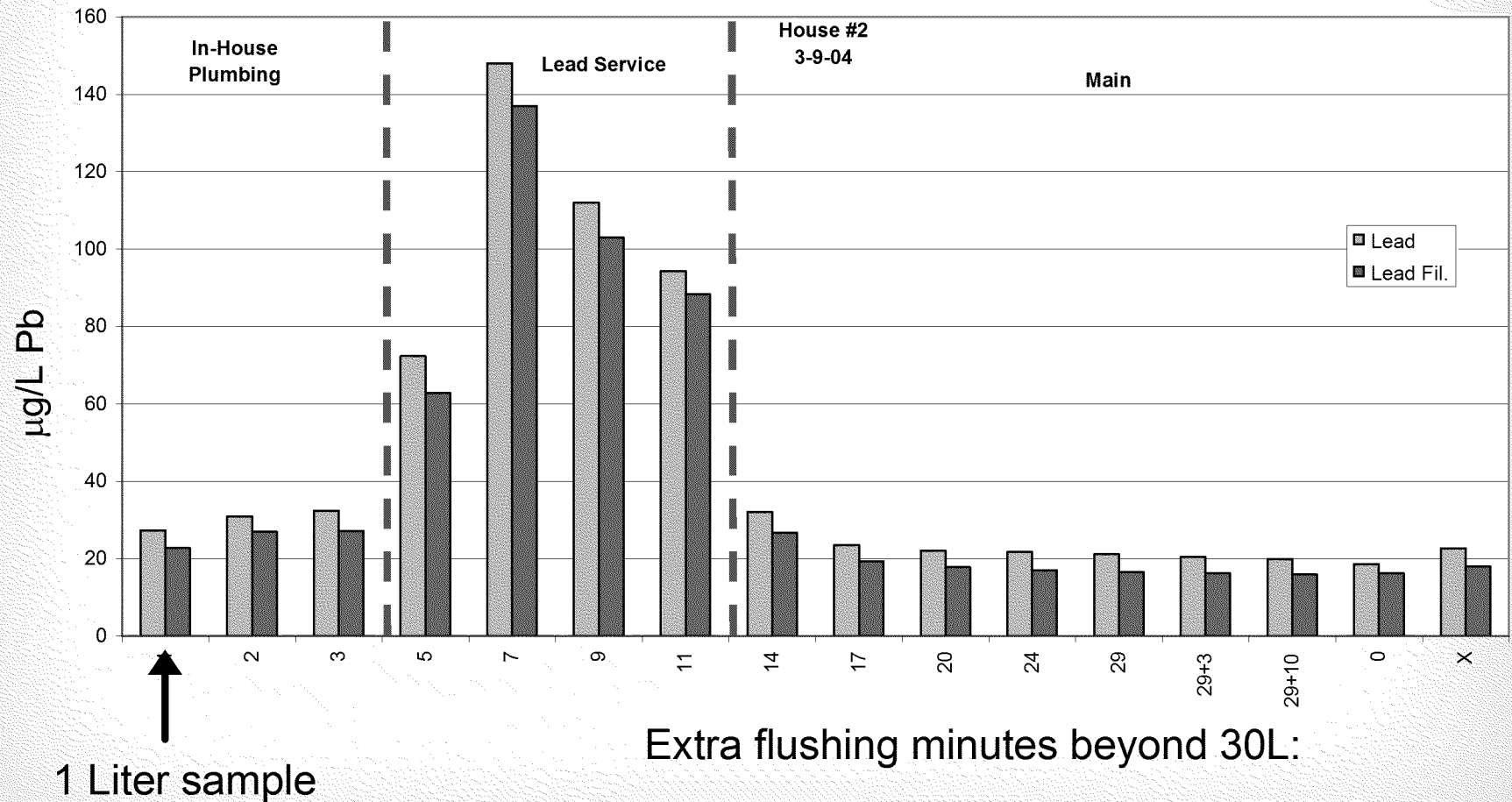
Lead in Drinking Water





First Draw May Not Reach Pb Contamination

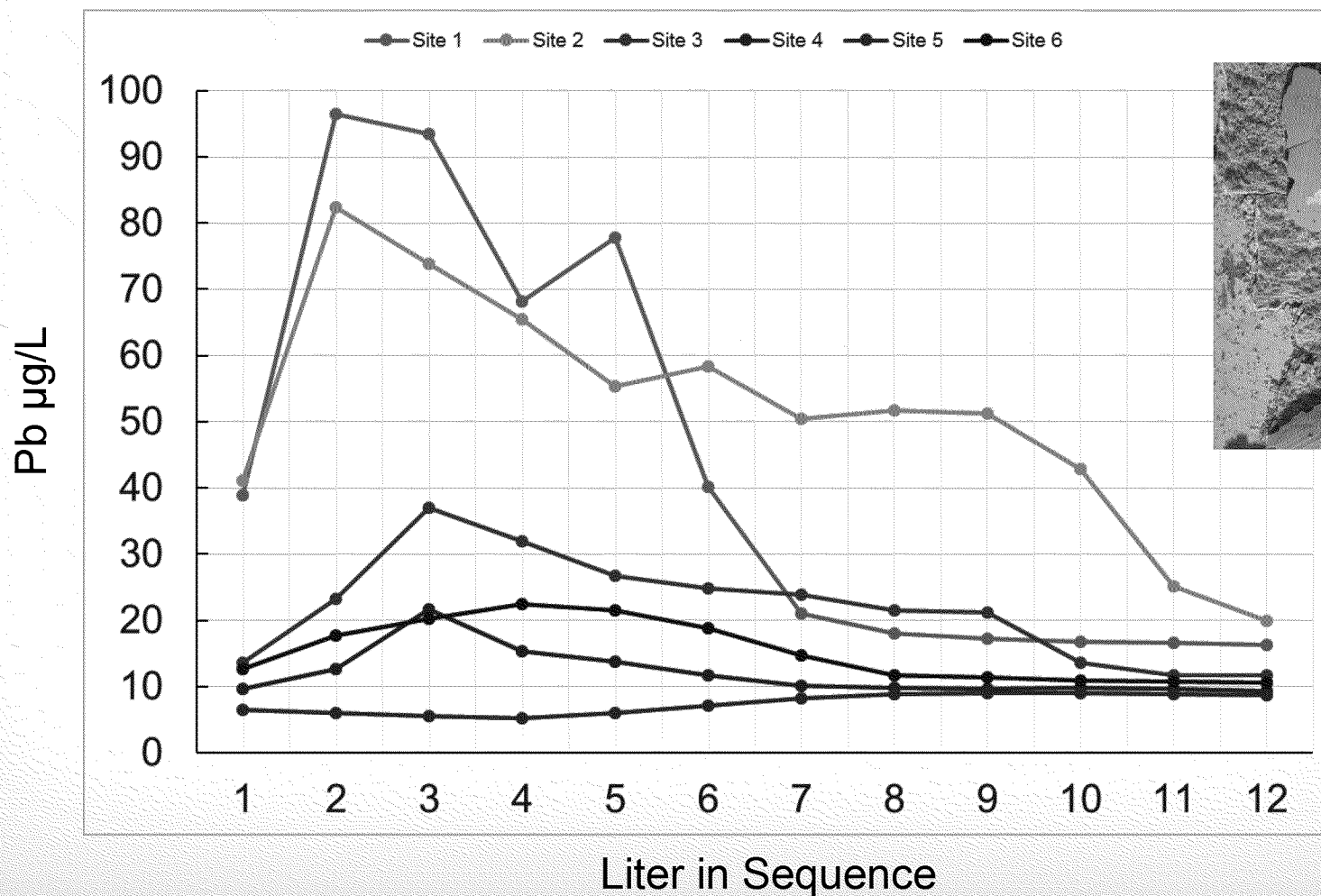
Need to "Profile" Sites for Public Education Flushing Guidance





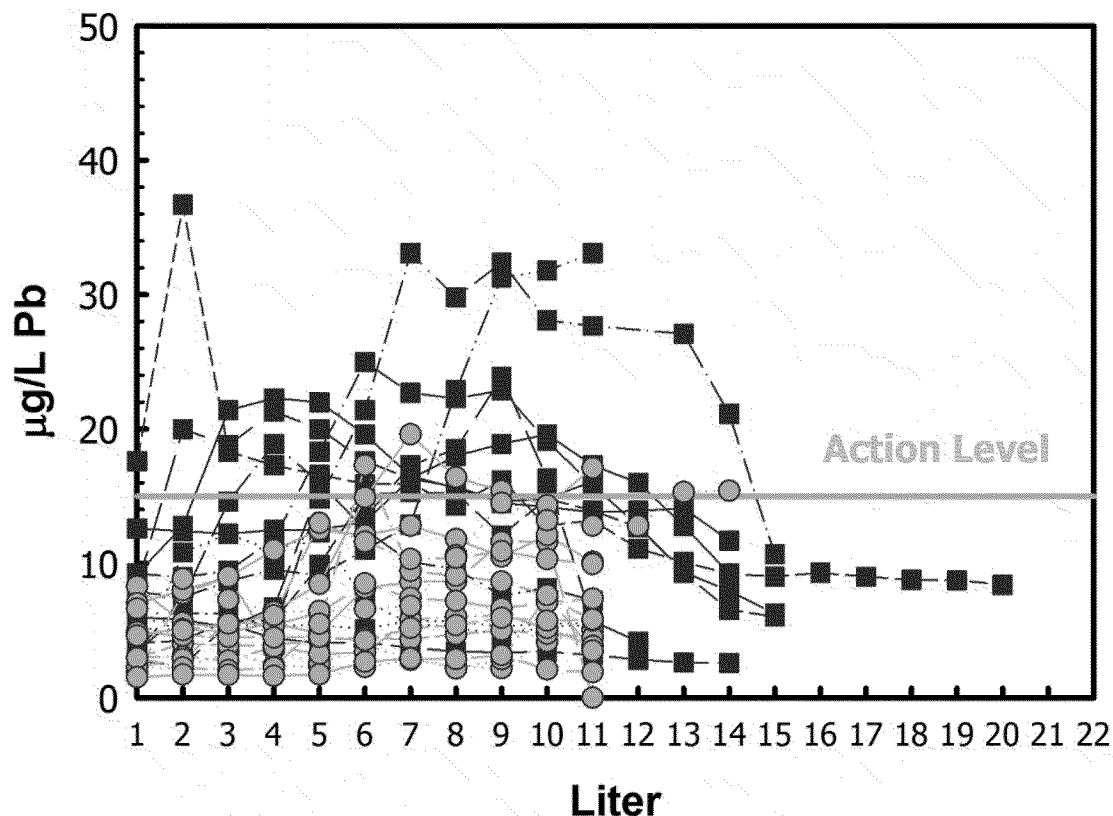
Pb Profile of Sites with Al-Si-Ca-Rich Deposit

< 10% Pb in surface scale, no crystalline Pb phases at surface





Impact of Disturbances in Past 7 Years Chicago (blended phosphate)

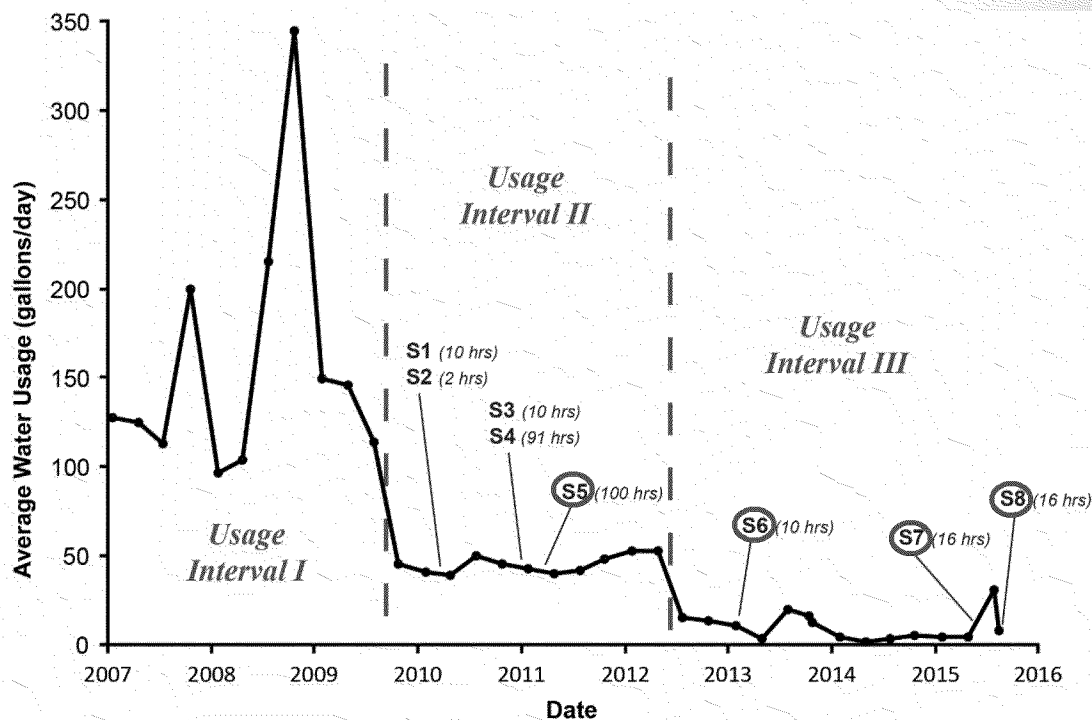
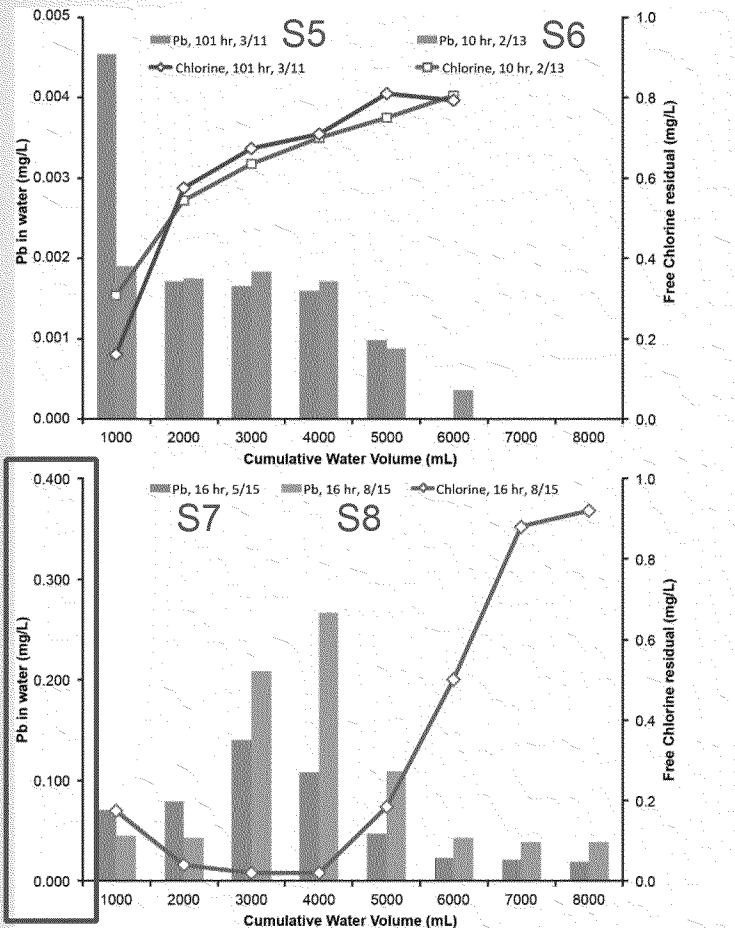


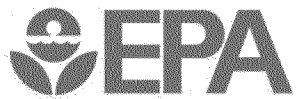
IMPORTANT POINTS

- Disturbed sites often double the Pb level
- Peak Pb liter varies with LSL length and plumbing configuration, consistent with other utilities that have done profiling
- Non-crystalline, amorphous scale
- Could not separate water use effect on lead levels



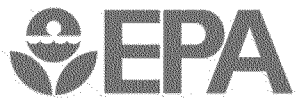
Beware of Vacant House & Low Use





Rule of Thumb from Profiling

- For systems with Pb(II) scales
- Peak Pb concentration in LSL \cong 4 to 8X 90th Percentile value



What Are the Risks of Leaving LSLs?

- Pb release can be high, erratic, or both, at any given site, *even with optimal corrosion control treatment*
- Infrastructure work (roads, main replacement, meters) will disturb pipe scales indefinitely
- Work on mains can leave air pockets that scour scale from inside LSLs and premise plumbing
- Utility may have to install extra treatment unit processes to remove interferences to passivation and lead release control
- Treatment changes, mistakes, accidents or natural disasters could mobilize massive quantities of dissolved and particulate Pb.



Approaches for Exposure Assessment

- Can be approached three ways
 - System-wide assessment of risk (population-based)
 - Targeted subgroup/pool of system, estimation of risk
 - Individual premise assessment of risk
- Demonstrated approaches by other countries or special studies
 - Random daytime sampling (RDT)
 - 30 minute stagnation, first liter (relies on leaded interior materials)
 - Proportional sampling apparatus



Approaches for Exposure Assessment (2)

- Promising future approaches amenable to bridging premise to community risk
 - Proportional samplers at taps of consumption in “representative” sites
 - POU-type filter units that aggregate and/or separate dissolved and particulate lead over known water use/time
 - Intensive RDT sampling at child exposure investigation sites, linked to water consumptive use (kind of manual “proportional sampling”)
 - Mathematical modeling of full profile, using simulated usage pattern (yet to be researched in US)

Notice:

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